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Social Sciences—
"Natural" or "Un-natural"

MANY people have recently said that we must learn to use "Social" Sciences to reduce human conflict before we have used the more advanced "Natural" Sciences to blow each other up. The statement, also, is frequently made that industrial managers are essentially social engineers since the productivity of the human groups under them so largely determines the profitability of their capital and equipment. Yet, there are still only minute amounts of corporate capital invested in social science research compared with the billions invested in physical science research.

When this contrast in investment is discussed, the defense is frequently made that the Social Sciences are inexact, immature and so frequently wanting when put to the practical test of corporate problem solving. One frequently runs into the comparison between the "Natural" Sciences and the "Social" Sciences. This raises the question as to whether the Social Sciences might not really be "un-natural" in some specific and important respects.

People say that human behavior both individual and social is such a complex phenomenon as to create uncertainty as to whether a scientific approach would pay off. But is human behavior more complex than the weather? Yet, think of the gigantic budgets now expended on a world-wide basis in the effort to analyze and predict and maybe even control the weather. Is human psychology inherently more complex than organic chemistry? Possibly, but not certainly.

For a long time, psychologists were denizens of the cloister while barbers practiced surgery, mid-wives obstetrics, witch doctors therapy, and priests the laying on of hands all without benefit of science. The beginnings of genuine health conservation came when physiologists taught the barbers and conducted clinics. A part, at least of the resistance to the slow, glacier-like advance of genuine science is the entrenched authority of an occupational group resisting being educated into a scientific profession. Thus, centuries are lost and humanity wrongly served. Goethe once said that the reason men taught what was not so, was that they were paid for it.

The history of science points out that man was first scientific about the stars. Even then, there were some burnings-at-the-stake and other forms of effective resistance. Although it is much easier to be objective and scientific about the more remote, might we drop the adjectives "natural" and "un-natural" from our discussion of science? Is not science one attitude, one method, one fabric of knowledge? Can we really and completely separate the study of society from the study of weather in which society operates. Food, agriculture, industry, health, crime, suicide, commerce, politics, and economics show many signs of being related.

Should we fix absolute barriers between chemistry, physiology, psychology, morale, personnel placement, training, health, and leadership? Do we not already have clear evidence that mental disease, character, temperament, and output are related to sugar metabolism and gland secretion?

If management means planning and determining events, the manager, who is scientific about a part of the events under his control but refuses the scientific approach for other parts, is like the side-hill chicken condemned to walk in circles around the hill because of a short leg on one side. If our "big wheels" in management go around in circles, could not our resistance to being all the way scientific explain this futility?

It is a happy sign that some large corporations are establishing policies, budget, staff and program in the management of human resources. But this goes on at a creeping pace. In the meantime, production and product research and physical science investment fairly explodes by doubling in decades. A recent figure showed two percent of a sales dollar going into product research and seven-tenths of one percent of the *personnel department budget* going into personnel research.

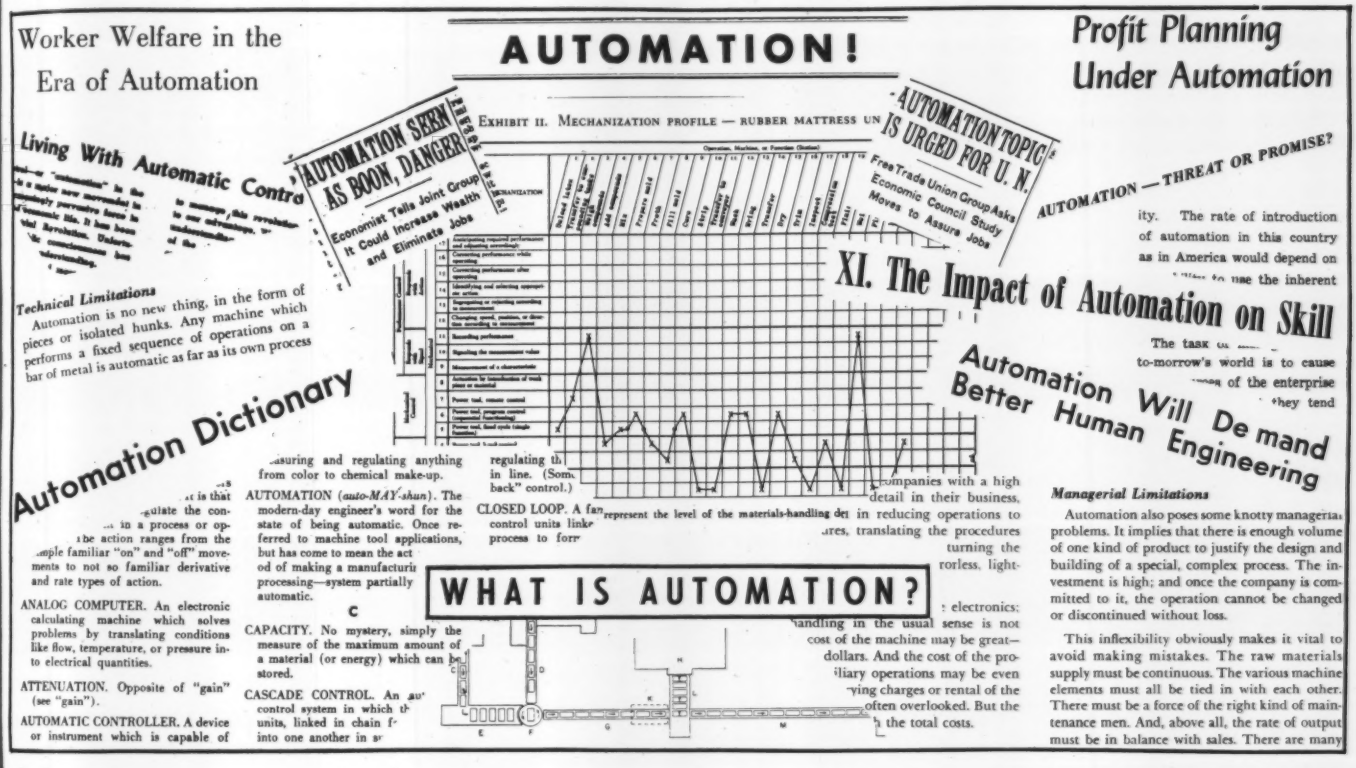
Management now readily accepts the physicist and the chemist as partners but still tends to keep the psychologist and the sociologist in the cloister, immunizing themselves by such adjectives as "ivory tower", "long hair", "high brow", and "academic." Such management attitude is today's equivalent of the barber resistance to physiology two hundred years ago. It is attitude and not logic. Any inadequacy of the behavioral sciences is logically an argument for rather than against their use.

The scientific study of human behavior demands "captive" populations; only governmental employees, school children, prisoners, and the insane are available for scientific advance unless corporate managers pick up the torch and pioneer in solving the remaining problems of scientific management. Only corporate managements can make the Social Sciences "natural"!

The cash dividends on such pioneering may well eclipse the past rich return on product and process research. The intangible dividends may be survival for both corporation and the incentive enterprise way of life.

F. F. BRADSHAW

Automation—Today's Challenge To Management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Automation Dictionary
WHAT IS AUTOMATION?
Technical Limitations
Managerial Limitations

NEARLY everyone is thinking, arguing, and writing about the new Industrial Revolution springing from automation, as the recent headlines above demonstrate. So why should *Advanced Management* add to the hubbub?

Undoubtedly automation is one of the most significant developments in business and industry which has crystallized in the past decade. But there are altogether too many loaded opinions and flighty predictions and altogether too few careful observations and authentic judgments expressed on the subject.

Automation is a complex socio-economic development which cannot be fully absorbed in the experience of one individual alone, or contained within the needs and interests of one group, social stratum, or community alone. But perhaps enough is now known about it for a fairly objective and accurate assessment to be made of its implications.

Six articles on automation are presented in this issue of *Advanced Management* by six writers with vastly differing backgrounds and jobs and attitudes. These articles were selected because they are full of facts, actual cases and analytical surveys on automation; because they express several of the strongest viewpoints on automation; and because each author seems aware of the responsible part he and others will have to play as the momentum of automation increases in the years to come.

The article giving "*An Application of Automation*" by Carl Demrick, Vice President in charge of Manufacturing of the Chrysler Corporation, sketches an exciting picture of the design, construction, and operation of one of the most fully automated facilities in the automobile industry, always a leader in the development of automation.

The article on "*The Economic Aspects of Automation*" by Edgar Weinberg, Business Economist in the Bureau of Labor Statistics, U. S. Department of Labor, evaluates the outlook for the growth of automation in the next decade, suggests the effects which it may have on a variety of working conditions, and describes studies which the government is making to cope with industrial dislocations which may result from automation.

The paper by Nathaniel Goldfinger, Economist in the Research Department of the A.F.L.-C.I.O., entitled, "*Planned Adjustment To Automation*," indicates various ways in which collective bargaining and thus management-labor relations will be influenced by the growth of automation in the years to come.

U.A.W. Shop Steward and Committeeman, Edward Falkowski, in his article on "*Automation Versus Model T's*," gives striking expression to the feelings of the men and women on our production lines and in our offices whose jobs may be affected tomorrow—next month—or next year—by automated machinery or electronic computers. Who knows when his own job will be buffeted by automation?

In his article on "*Human Adjustment To Automation*," Arthur Turner of the Technology Project of the Yale Institute of Human Relations, shows us that not only employees but also managers have serious adaptations to make as operations in offices or shops under their management are automated. He points out productive lines for future automation research.

Finally, Erwin Schell brings future management needs and responsibilities arising from automation within our ken in his penetrating analysis of "*Industrial Continuum And The Nature Of Man.*"

If you feel these articles have given you solid food for thought, our purpose in presenting them will have been fulfilled. ■

The new Plymouth engine plant in Detroit, generally considered to be the most advanced facility of its kind in the world, was designed with one main objective in view—to increase the efficiency and lower the costs of engine production. To attain this objective, automatic machinery was used extensively. The problems encountered in planning and building this plant and the decisions made along the way afford many practical illustrations of the meaning of automation for industry.

Management Views An Application of Automation

By Carl J. Demrick
Vice President, Manufacturing
Plymouth Division
Chrysler Corporation

OUR new Plymouth Engine Plant in Detroit is a good example of automation in practice. We are proud of this plant and it has made us very happy to learn that many people have called it the most highly advanced productive facility in the automotive industry.*

Some have gone so far as to call this new plant a push button factory. This, of course, is incorrect. In theory, at least, a push button factory is one that requires only a few operators sitting at control panels. The Plymouth Engine Plant is far from being this kind of facility. Its normal working force is about 3,000. In building a product as complex as an automobile engine, there are many operations which can be done more efficiently and economically by making full use of the human brain, hand, and eye—and no manufacturer in his right mind is going to automate for the sake of automation when it makes so much more sense to employ people to perform the work which they can do better or more economically than machines.

Figure 1 (on page 7) will give you an idea of the plan of the Plymouth Engine Plant. This is the layout of the plant showing the flow of work from the extreme right where the cylinder heads and cylinder blocks are machined, over to the extreme left where the engines are given their final test and are then shipped by truck or rail. At the bottom of the diagram is the engine assembly line with a sub-assembly for the engine head. You will notice that all the components of the engine feed into this assembly line. These components include such things as crankshafts, camshafts, flywheels and manifolds. You will notice at the top of the diagram that there are two receiving points for incoming stock. The one at the right is for the heavier components—the block and the head castings. The one at the left is for all of the other components.

Of all the features in the engine plant none of them causes so much comment among visitors as the hot-test line. (See Figure 2 on page 9.) The new engines, loaded onto pallets, roll onto this line looking for a place to stop and be tested. When an engine finds an empty test stand it automatically stops and rolls into the stand. It is automatically hooked up to water, gas, oil and electric power lines. Then the new engine is automatically started by an air motor. The complete test cycle takes 20 minutes.

Now that you have some idea of the kind of plant we built, I would like to tell you why we built it that way.

A plant like this always begins with a need. In 1954 we were tooling up to produce our 1955 cars—the first of the Chrysler Corporation cars which have come to be known as the Forward Look models. At Plymouth Division, especially, we were planning big things for the new cars. In addition to their new styling, they were to have V-8 engines for the first time. We knew, however, that our capacity for producing the newly designed Plymouth V-8 engine was far less than we would need. As it turned out, in our first year with the

CARL J. DEMRICK

A native of Michigan, Carl Demrick began his career with Chrysler Corporation in 1934 in the material handling department of the Plymouth plant. He moved through successive positions as an apprentice in tool making, a tool designer, foreman of the Bofors gun project during World War II, heat treat and tool engineer, master mechanic, and supervisor of the central estimating department. In 1954 he entered his present position of vice president in charge of manufacturing.

From a paper delivered at the 11th Annual S.A.M.-A.S.M.E. Management Engineering Conference, held in New York on April 26-27, 1956. The complete Conference Proceedings will be published shortly.

Forward Look models we were never able to supply more than three cars with V-8 engines out of every ten cars we produced.

We needed a new plant for V-8 engines that would come into production in time to power a large proportion of the 1956 model cars, and we wanted that plant to turn out at least 150 engines an hour.

We were shooting for more than capacity, however. We also wanted the kind of plant that would lower our costs of production. As you know, in the automobile business the competitive drive for lower production costs is just as hot and continuous as the drive for sales. We believed that the best way to reduce costs in our engine plant would be to build the highest possible precision into the machinery and to equip the plant with automatic machine controls that would reduce to a minimum the possibility of error. The result would be reduced expenses for trouble shooting, maintenance and repair, reduced down time for machines, and minimum loss from scrappage.

High quality and low costs became the ruling considerations in designing and building this plant. And now that the plant is producing, we are finding that it has justified the time, effort and resources invested in it. We call it the Qualimatic V-8 Engine Plant, and it is fully living up to its name. The plant contains far more than an average amount of automatic machinery. It is generally recognized as the most highly automated engine manufacturing facility in the automobile industry.

As we all know, automation is a much misunderstood word. Every man seems to have his own definition, and I have mine. On the basis of what we have learned about automation at the Plymouth Engine Plant, I believe that automation might well be defined as *the optimum use of machines to produce high volume, high quality products at the lowest possible cost.* That definition is, in a way, a description of the kind of plant we wanted to build, and the kind of plant we now have. To build the plant we worked according to two simple, but I think very meaningful, principles. Let me explain what they were.

1. Our first guiding principle was, *to use machines only were they would bring a clear advantage in cost and quality over the use of manual techniques.*

In theory, of course, you could design automatic machinery to perform virtually all of the jobs done in our engine plant, or for that matter, in an automobile assembly plant. In other words, a push button engine plant is hypotheti-

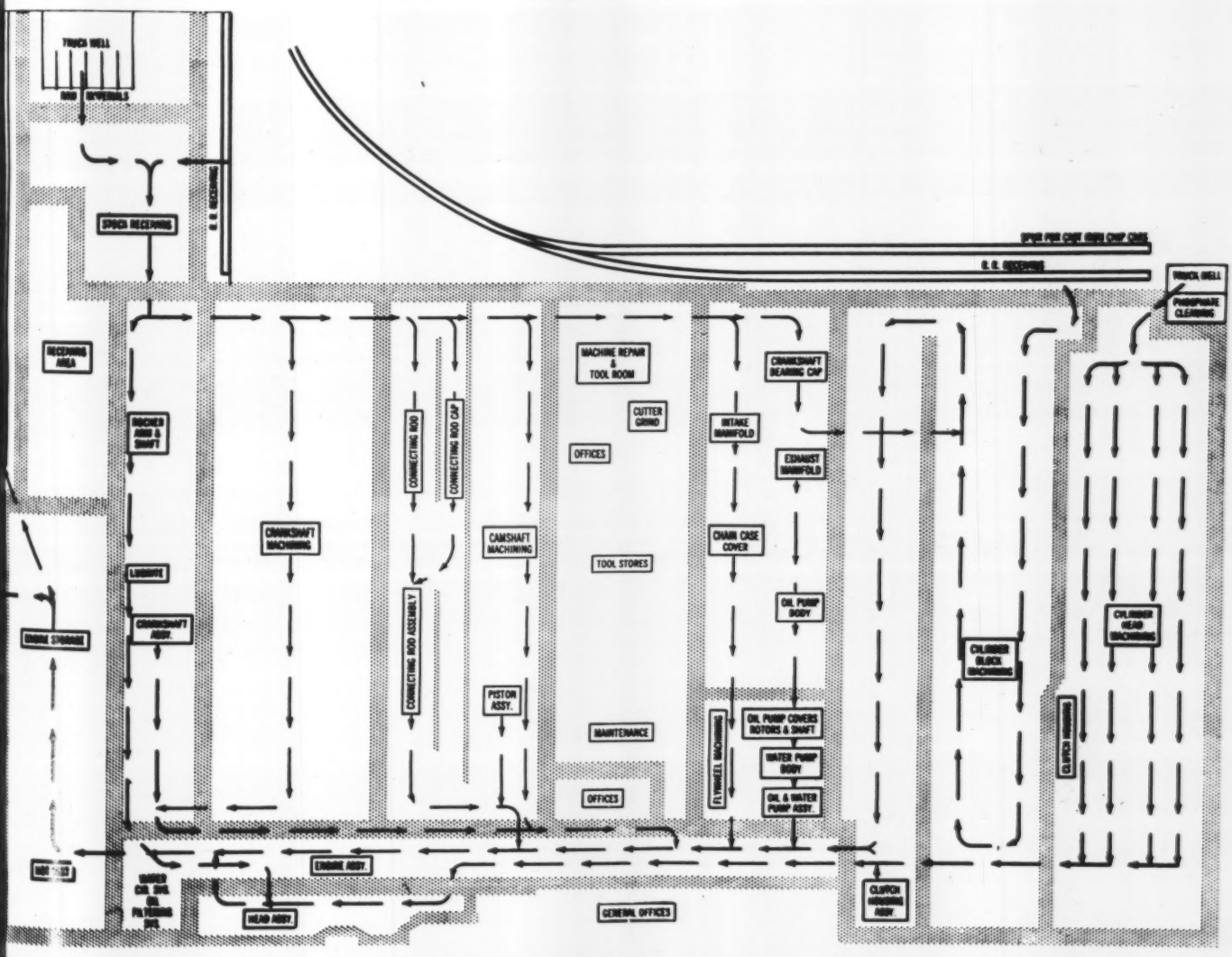


Figure 1

A schematic diagram of the new Plymouth V-8 engine plant, showing flow of material throughout the installation.

cally possible. In my opinion, however, such a plant will never be designed or built. For one thing, it would not be economically feasible to build automatic equipment to perform work that can be done more economically by people. And under modern conditions, with products changing so rapidly, it would be bad policy to invest heavily in equipment designed for building this year's product if the equipment might have to be scrapped or basically re-designed next year. For another thing, there are many jobs in a plant of this kind which can be done better by human beings than by machines. It would be difficult to imagine, for instance, the kind of machine that could be substituted for the inspector on the engine *test* line who listens to the running engine to make sure it has that unmistakable sound of a well-made and well-tuned V-8. There are many other jobs in the plant—quite apart from the hundreds of maintenance and repair jobs—which we would rather entrust to people than to machines. Some of the most important of these jobs are on the engine assembly line where, for instance, connecting rods must be put in place carefully to give them the right clearance, and where tappets must be properly adjusted.

MACHINE JOBS

On the other hand, there are many operations in this plant which are performed with far greater consistency and greater precision by machines than they could possibly be accomplished by people. In addition to the many broaching, drilling, chamfering and reaming operations which have long been done by heavy automatic machinery in the automobile factory, there are many hundreds of additional operations which can be done more advantageously by automatic machines than by people. Take, for instance, the nut-runners that tighten head bolts hour after hour and day after day to exactly the right torque; or the automatic counters on the tool-control boards which indicate when the wear-out point is approaching. In another part of our plant we load parts trays with small components like bolts, nuts and washers by means of automatic hoppers which seldom make a mistake in the number of parts they count out and drop into each tray. In this same section, however, we also employ people to load these trays with odd-shaped parts that would be difficult and costly to handle by automatic processes.

Naturally, it is much easier to put this principle into words than into practice. Deciding when to use machines and when to use manual methods requires the consideration of many factors and the working out of some extremely complex equations. The only way to prove that you have worked out the equations correctly is to put the plant to work and apply the test of practice. I am happy to say that in the few months that our Plymouth Engine Plant has been operating we have been gratified with the results. Repair on engines has been extremely low, maintenance costs have been at a minimum, scrappage has been drastically reduced, and down time on the production lines has been lower than we have ever experienced on any other equipment approaching this in size and complexity.

PRODUCT AND PROCESS DESIGN

2. Our second guiding principle was that *the design of the product and the design of the plant process should be related to one another as closely as possible to the end that the efficiency of the plant may be raised and the quality of the product improved.*

When stated in this way, this principle seems so simple and so reasonable that you would assume all product engineers and production engineers must have accepted it and used it without question as far back as things like automobile engines have been designed and built. The truth is, however, that product design and plant design have traditionally tended to be separate domains. In Detroit it is not unusual, for instance, to hear production engineers in the stamping plants complain about the "impossible" things the body designers are asking them to do with sheet metal. Of course, these impossible things are eventually accomplished by drawing upon ingenuity and upon the endless possibilities of modern machine technology. Moreover, no body designer could afford to work in ignorance of the capacities of the most advanced stamping facilities. He is pretty sure when he drafts his design for a new automobile that it is capable of being mass produced, and his designs are brought to the attention of the production people for clearance as early as possible. But all things are matters of degree. In my opinion there is a much higher degree of communication today between product designers and plant designers than ever before. What happened in designing the Plymouth Engine Plant to build a specific kind of V-8 engine is a beautiful case in point.

When we decided to build this plant, we did more than establish an open line of communication between the engineers who were designing the plant and the engineers who were designing the engine. We literally made them live together. The two men with the chief responsibility for deciding on the sequence of operations and the kind of equipment to be used in the plant established temporary offices in the central engineering laboratories so that they could see and talk personally with the product engineers at all times. When they decided that the engines would have to have lugs of a certain kind to be palletized for the assembly line, they asked the engineers if there was any technical difficulty in providing the lugs. When they decided that the pistons would need to be re-designed in order to roll properly in troughs, they explained their need and the product engineers re-designed the pistons. Similar changes were made on dozens of parts of the engine to provide for automatic locating or moving. As far as I know, the consultation between product design and production design on this job is the closest ever achieved in our company.

DESIGN CORRELATION REQUIRED

In my opinion, this kind of close consultation will become more and more the accepted procedure in industry. In an age when innovation in the product is such a dynamic force in creating market demand and when mechanical progress in the means of production is moving faster than ever before, it has become absolutely necessary that the men who design the new products work side by side with the men who design the machines to make those products.

I have mentioned some of the features of our engine plant that were achieved as the result of close teamwork of our design and production engineers. At this point I would like to mention a few additional features of the plant with special emphasis on the ways we achieved an unusually high degree of quality control.

The greatest single problem in controlling the quality of engine manufacture is the difficulty of holding close-to-perfect alignment between various cutting operations on a machined part. In the past, most of the trouble has been caused by the fact that each cutting

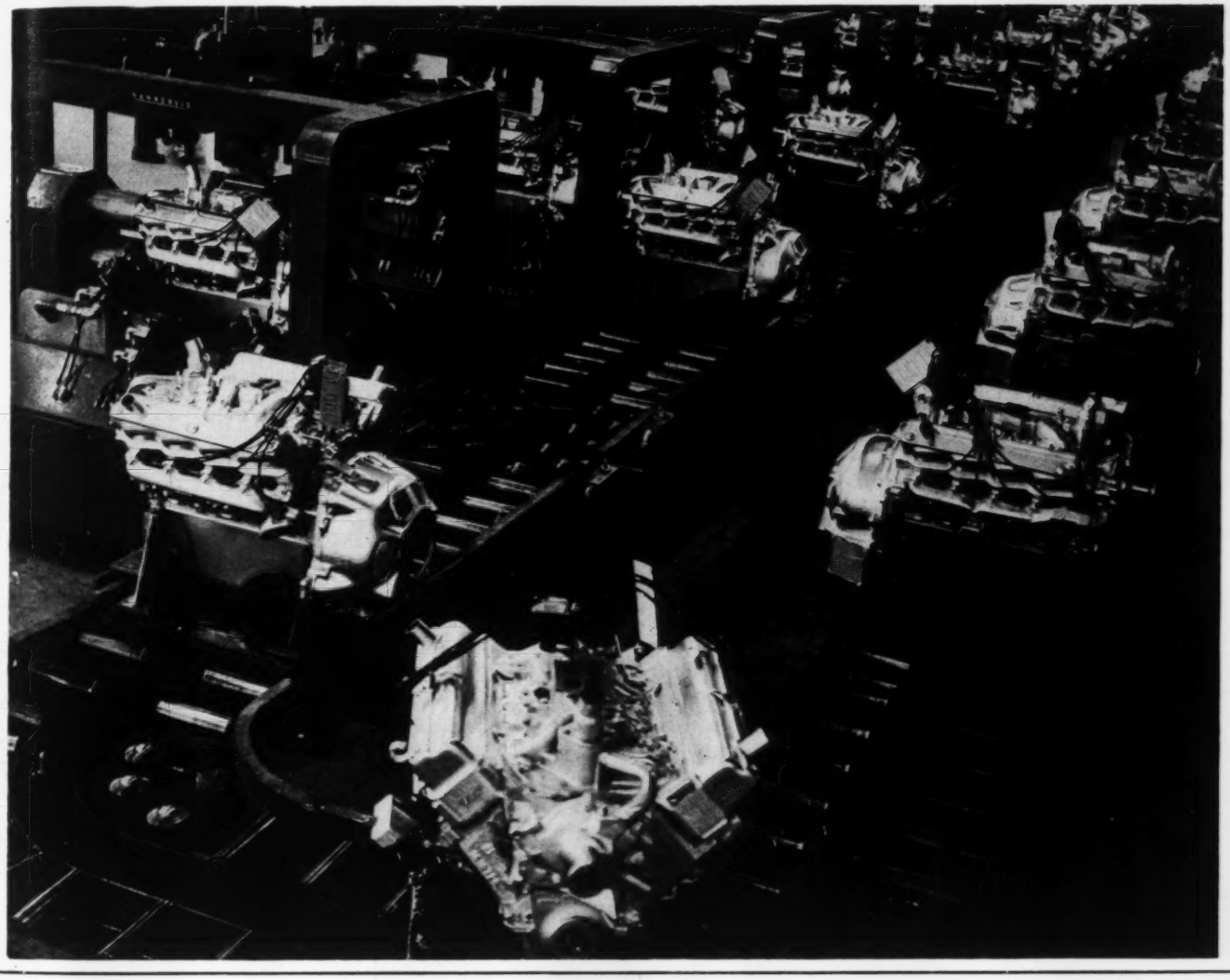


Figure 2

The hot-test area in the Plymouth V-8 engine plant, which receives the motors by overhead conveyor from the electrostatic painting activity and tests them automatically.

operation was performed separately, with the part then being passed on to the next station. When a number of holes are bored, drilled, or reamed in a workpiece at more than one station, the holes must be held in perfect alignment with each other. But under these conditions it is difficult to avoid inaccuracies because clamping is never exactly the same from station to station.

These difficulties have been largely overcome in the new Plymouth plant by increasing the number of operations performed on each machine. For instance, on the cylinder-block line, one four-way boring machine is finish-boring the main bearings, camshaft bushings, distributor shaft hole, the oil pump shaft holes, and the dowel holes at the end of the block, and at the same time it is milling the oil pump pad. Since these six operations are being performed simultaneously on one machine, the relation of each dimension to all the others is held very accurately.

The practice of performing multiple operations on as few machines as possible is not new, of course. Throughout the industry, fewer and fewer machines are required for more and more operations each year. For example, it was not long ago that as many as 12 milling machines were required to work the flat surfaces of engine blocks at the rate of 110 an hour. Today, two broaches machine those surfaces at the rate of 140 an hour.

Some of the most interesting features of the plant are those having to do with testing the pieces as they are being worked. This testing process begins back at the foundry. We produce castings for the head and block lines of the finest quality attainable, and we do this by controlling quality throughout the entire casting process. The castings are also produced with extremely close limits on the stock to be removed in the machining process. Before any casting is allowed to go into the machining lines it must first pass through a qualifying machine. Any castings that exceed the specified dimensional limits are ejected immediately.

In making the decision to use broaches rather than milling machines for the flat mating surfaces of the cylinder block and head, we had to make sure we could control the quality of the casting both as to its dimensions and the consistent hardness of the metal. While broaching gives a greater production of parts per hour than milling, in comparable machine investment, in the past one of the principal sources of down time for broaches was tool breakage as the

result of occasional "hard spots" in low quality castings.

Througout the plant there are automatic testing devices to make sure a piece has been properly worked. Following every drilling operation in the head and block lines, for instance, there are automatic probing stations equipped with feeler gages to insure that holes have been machined to the right depth and that they are free of broken tools. If no hole exists where there should be a hole, the machine is stopped automatically at that point until the cause of the defect is rectified.

After many of the machining operations we use air gages to check dimensions. If tolerances are exceeded, the machine operators are informed immediately by means of colored lights at their control panels. At the same time, one of three lights on the machine goes on automatically and informs tool men in the working area of the trouble so that it can be remedied in a matter of seconds. At many points there are gages which indicate, also by means of colored lights, that holes are approaching the "out-of-tolerance" range.

What is the effect of this automated plant on the people who work in it? In the first place, I believe I can say without distorting the actual situation in any way that the people working in this new plant have a considerable sense of pride in their place of work. Every day they see many visitors pass their work stations, visitors who have heard about the plant and who are intensely interested in what they see. In the second place, many of the people in the plant have far better jobs today than they once had, with higher ratings and higher pay. This is true because the proportion of maintenance workers, such as electric repairmen, millwrights, and tool setters, is much higher in a plant of this kind than in one that is less advanced. Beyond these advantages, the people who work in this kind of plant know that their working hours are safer, less fatiguing, less monotonous, more productive, and more interesting than they would be in a plant with less automation.

EFFECT ON EMPLOYMENT

I am often asked what effect this new plant has had upon employment at Plymouth. In January of this year, in an attempt to give a good answer to this question, I took a representative working day, January 15, and made a count of the number of people at work in the company on the production of Plymouth engines, both V-8's and sixes. Then I compared this with the number of people producing engines on the same day of the two previous years, before the new engine plant was in operation. Here are the facts I found:

On January 15, 1956, 6,533 workers were employed in building Plymouth engines of all types.

On January 15, 1955 the number was 5,322.

On January 15, 1954 the number was 4,297.

I want to be the first to say that the importance of comparisons of this kind should not be exaggerated. It is difficult to account for all the factors so as to make any given day strictly comparable to the same day in other years. Nevertheless, the figures do show there has not been the sudden drop in employment, or the displacement of workers, that many people expect to result from the building of a plant of this kind.

It is true, of course, that people are switching to different kinds of work in the plant or in the company. And the company is helping them to prepare for the new opportunities and responsibilities that open up as the result of these new kinds of equipment. Classes are now being offered, for instance, in electronics and industrial hydraulics for journeyman electricians and machine repair men who completed their apprenticeships before these fields were included in their studies about seven years ago. To date, 154 employees have completed a two-hour-per-day, 24-week training course in industrial hydraulics, and an additional 178 employees are now enrolled in the course. A similar 48-week course has just graduated its first class in electronics. All courses of instruction are held on company time, during regular working hours.

SIGNIFICANT ADVANTAGES OF AUTOMATION

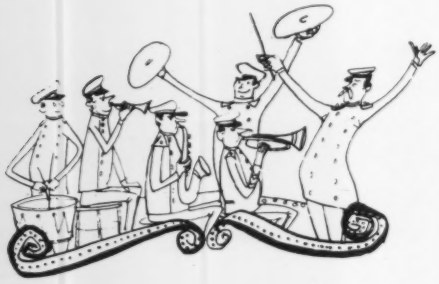
Speaking generally about automation, it appears to me that it offers three tremendous advantages to the economy.

First—automation is coming along at a time when the total population of this country is increasing much faster than the number of people available for productive work. It has been estimated, for instance, that in the next ten years the population will increase by 20 percent and the portion of the population available for work by only 6 percent. In this situation, with proportionately fewer hands to do a lot more work, automation is going to be a very timely blessing indeed.

Second—by increasing our efficiency in the volume production of goods and services, automation will help us control the pressure toward inflation which is nearly always-present in a dynamically expanding economy like ours.

Third—like every other advance in efficient production, automation will raise quality, lower costs and widen markets. And this will put steam into the forward drive of the whole economy.

This is the broad view. The closer view we have of the application of automation at the Plymouth Engine Plant has shown us its advantages in producing higher quality products in large volume. And I can assure you that the Plymouth Division and Chrysler Corporation as a whole are going to keep building the most modern plants possible to achieve more of these advantages. ■



CHAPTER HONOR ROLL

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Current developments in automation are related to preceding industrial and technological trends and to the postwar economic situation. The outlook for automation is evaluated on the basis of the economic and social factors which will affect it. Problems which automation may create are considered such as varying working conditions, labor displacement, changes in occupational requirements, apprentice training, and collective bargaining. Some of the measures the government, particularly the Department of Labor, is undertaking to meet these problems are discussed.

A Government View—
The Economic Aspects of Automation

By Edgar Weinberg
Business Economist
Bureau of Labor Statistics
U. S. Department of Labor

THE term "automation" has now been extended, through popular usage, beyond Mr. Harder's and Mr. Diebold's original technical definitions to encompass an ever wider range of innovations of varying degrees of automaticity. Generally, the present movement brings together changes that eliminate direct human intervention in production by substituting power-driven machinery for human muscle, precision instruments for human sensory discrimination and motor control, and electrical circuits for human response. When the parts are linked together to accomplish a given task, the production system is even more impressive than the individual developments considered separately.

This article deals chiefly with the implications for unemployment, displacement, occupational requirements and training, of removing the worker from direct step-by-step control of production. First, however, we consider the historical background and view of the outlook since many of the problems of worker welfare under automation are related to those created by technological change generally, with which this nation has had many years of experience.

Today's movement toward greater automatization of factory and office work appears in the light of history as a new or third phase in the technological evolution of American Industry. The first stage was the shift from handicraft to machine industry during the 19th century. The American system of interchangeable parts manufacture, the improvements in metal cutting tools and the invention of various types of specialized fabricating machinery that duplicate the motions of hand labor certainly marked important advances toward greater automaticity. Carroll D. Wright, first Commissioner of Labor, for example, recorded in his monumental 1898 report, *Hand and Machine Labor*, a spectacular 900 percent increase in man-hour output in manufacturing shoes by machine methods of his day as compared with the hand methods of 1863.

The second or mass production phase is often described as the "Ford Revolution," which reached its climax during the 1920's. It involved more extensive use of moving conveyors and automatic machinery, electrification of industry, and the standardization, simplification and specialization of processes and products. The A. O. Smith plant where automobile frames were produced "untouched by human hands" was hailed as an example of the automatic factory of the future. Ewan Clague, the present Commissioner of Labor Statistics, in 1926 summed up the improvements of that period as a "new industrial revolution . . . the most remarkable advance in productive efficiency in the history of the modern industrial system."

The latest stage in this general development toward greater mechanization is the one popularly called "automation." Electronic data processing, integrated handling and processing, and feed-back control systems are perhaps its most impressive elements. Faster, more automatic machine tools, the automatic assembling of electronic goods, and improved models of conventional

EDGAR WEINBERG

With the Bureau of Labor Statistics as business economist since 1952, Edgar Weinberg has worked on automation, productivity, employment trends, government finance, and labor statistics, and is now making a series of case studies of automated plants. He contributed the chapter on automatic technology to the forthcoming Twentieth Century Fund study of the outlook for American technology. Prior to his work with the Department of Labor, he was with the Veterans Administration and the Social Security Board, and served with the U.S. Army in World War II.

machinery, which though not self correcting, go through a cycle without human intervention, are also important tendencies.

The unique background of automation has been the unprecedented advance of the economy since the end of World War II. New developments were adopted by firms in a strong financial position which sought to make up the technological obsolescence that accumulated over more than a decade of war and depression and to apply in civilian industries mass production techniques learned on defense contracts. The steady upward pressure of wage rates on costs stimulated a keen interest in labor-saving devices of all types. With expenditures on producers' durable equipment at a level twice as high as the 1929 volume, with a current annual expenditure of some $3 billion a year on industrial research and development, and with important scientific advances in electronics, American technology was bound to take on a new appearance.

Forecasting the future rate of growth of automation involves consideration of such complex intangibles as the growth of scientific knowledge, the motivation of purchasers of capital goods and the way both producers and consumers adapt to the changes. It requires on the part of the forecaster, as Dr. Irving Siegel has suggested, "a high propensity to assume."

THE RESEARCH STIMULUS

An important stimulus, undoubtedly, will be the large expenditures on industrial research and development. It is estimated that over $5 billion a year was spent in 1955 for scientific research and development. According to Dr. H. Leedy, of the Armour Research Institute, the annual rate may increase by 50 percent in the next decade. While much research is for defense purposes, automation for civilian applications will probably benefit, as it has in the past. Competition among producers of equipment will also speed the advance of automation, as will the recent release of numerous patents related to automatic control and the use of new tools of research.

The progressive outlook of American industry tends to speed the diffusion of new techniques. "Invention," Thorstein Veblen wrote forty years ago, "is the mother of necessity." We still respond to the competitive system, the "passion for productivity" and sense of "adventurous urgency" toward technological improvements that so impress foreign observers.

Businessmen's optimism about the future continues to be a potent force for economic growth. According to the Commerce Department's latest survey, business plans to spend more in 1956 than the record year, 1955. Whether for expansion or replacement, these investments will no doubt provide opportunities for installing new types of equipment.

MORE AUTOMATED EQUIPMENT

The use of automation equipment now available appears to be at an early stage of growth. According to a mid-1955 survey by the Controllership Foundation, for example, only about 15 companies actually had large scale data processing systems for use on insurance records, payroll and similar routine clerical work. Many others have, of course, been installed in private and government offices for engineering and scientific research calculations. By 1957, however, one industry expert estimates that as many as 400 large computers will be in use for commercial problems, such as budgeting, inventory and sales control.

More companies are expected to adopt special electronic devices for use in air ticket reservation control, freight classification yards and warehousing. Dr. Cledo Brunetti of General Mills, Inc. estimates a doubling by 1960 compared to 1953, in the sales of industrial process instruments and a sixfold increase in the sales of industrial TV. In the manufacture of electronic goods themselves, automatic methods are making gains, with most of the major producers either using or planning to use some type of assembling machine and printed circuitry.

In mass production metalworking plants, the use of automatic equipment is growing, particularly among automotive companies. The McGraw-Hill survey in 1955 of some 1,500 metalworking plants showed that about one out of five use already some form of automation: transfer machines or transfer devices, automatic loading and unloading, or automatic assembly. The survey also indicates that metalworking companies plan to buy nearly $2 billion worth of new tools during the 18 months prior to the end of 1956. This certainly will create opportunities for introducing greater automation.

While steady progress toward more automatic production in certain sectors of the economy is expected, virtually no one regards the automatic factory (such as the one Eric Leaver and J. J. Brown projected ten years ago, where computers would direct not only fabricating but also receiving, handling, inspecting, packaging and production planning) as practicable for the foreseeable future. Cost, reliability of equipment and the availability of trained personnel are still the most important factors in determining the limits of automaticity. Indeed, these two pioneers recently stated a view widely shared: "Automatism can be expected to grow up in industry in stages—progressing from single local applications of electronic instrumentation to electronic control devices. . . ."

A convenient, if only partial way of summing up recent technological developments and assessing the outlook is to equate automation with one of its most significant aspects—changes in output per man-hour or productivity. The Bureau of Labor Statistics' recent comprehensive report on productivity trends for 1947-53 period and from 1939 to 1947 provides valuable statistical data on the important manufacturing sector of the economy.

For the 1947-53 period output per production worker man-hour increased at a rate of 3.0 to 3.6 percent per year. Between 1939 and 1947 (omitting the war years) the rate of growth was between .5 and 1.5 percent per year. Thus, although productivity growth was depressed by the war and reconversion, it apparently returned to the long term growth rate of 3.3 percent per year that marked the 1909-39 period.

ACCELERATED PRODUCTIVITY

Unofficial estimates (based on less comprehensive data) prepared by Leon Greenberg and his associates at the Bureau of Labor Statistics suggest some acceleration in productivity advance in the 1953-1955 period. Output per man-hour in this short period after the Korean War advanced at a rate of 5 percent a year. This is about equal to the rate of change in the immediate post World War II years (1947-1950) and approximates the annual rate for the 1919-1929 decade.

Turning to statistics for broader sectors of the economy, we find a somewhat similar picture. Productivity for the private non-farm economy has in-

creased at a rate of about 3.5 percent per year, considerably higher than the long term average rate of about 2 percent per year.

In short, using productivity growth as a yardstick, we have some evidence for believing we are in a period of relatively more rapid changes in technology, particularly compared to developments of the depression and war periods. Whether current changes will prove to be more dynamic than the mass production era of the 20's and the dimensions of the social problems consequently larger, however, remain to be seen.

While technology moves toward greater automation, this can hardly be considered our primary objective. Alfred Marshall, at the turn of the century, offered this still pertinent reminder: "So far as the economy of production goes, men and machines stand on much the same footing, but while machinery is a mere implement of production, man's welfare is also its ultimate aim. . . ."

A major concern today is to determine ways of assuring that technological progress will lead to the social goals cherished by most Americans. Stated in the words of the President's Council of Economic Advisors, these are "better living in all of its aspects, not merely indefinite increase in per capital income and possessions." The objective encompasses such intangibles as more leisure, the availability of useful work, greater opportunities for advancement, and lessened drudgery, severity, and monotony of labor.

GOALS TO BE SOUGHT

So far as the material level of living goes, it is easy to demonstrate that a rise in output per man-hour will determine its future rate of growth. For this purpose, we may roughly define the level of living as the total output per capita. This rate is algebraically equal to the product of three factors: the proportion of the population employed; the hours of work per worker; and the output of goods per man-hour.

The implications of a 3 percent annual growth in output per man-hour in the private economy can now be readily seen. Let us first assume that unemployment rate is no higher in 1970 than in 1954 and that the average work week remains unchanged. Estimates to 1970 show a slight decline in the proportion of the labor force to population. Within this framework it is evident that a 3 percent growth rate in productivity would imply a nearly 3 percent annual rise in gross national product per capita, compared to the 2 percent average rise we had from 1909 to 1953.

Not all of the gain in productivity may be taken in the form of goods and services. Greater leisure is also desired. Over the past 50 or so years, about one third of the potential gain in national output was "given up" in favor of a shorter work week. Today, organized labor seeks shorter hours, longer vacations, earlier retirement and longer schooling as ways of sharing in the economy's rising productivity and of maximizing employment opportunities.

While the potentialities of productivity growth for enlarging the nation's material abundance and leisure are now well understood, many in all walks of life nevertheless remain fearful that automation may endanger the job security of large numbers of workers. As the boom of the immediate postwar years wear off, this anxiety tends to mount.

As regards total unemployment in the economy, the statistical record for the most recent past period, like that for the long term, does not indicate a rise in the unemployment rate which can be attributed to the growth of productivity. Between 1947 and 1953, output per man-hour in the private economy increased by 24 percent. The growth in overall production amounting to 31 percent more than compensated for both the decline of unit labor requirements and the increase in the labor force. In fact, total civilian employment was about 7 percent higher in 1953 than in 1947.

It should be noted that not all industries and plants can expand their output and employment. Some displacement of workers therefore is always taking place. Firms that do not adopt cost cutting equipment often lose out to those with competitive advantages due to lower unit costs. Despite price reductions, some plants fail to expand output sufficiently to absorb those displaced because of an inelastic demand for its products. The technological factor is always difficult to disentangle from economic factors that cause dislocations.

So far, the actual rate of displacement on the whole appears to be relatively low. The monthly layoff rate in manufacturing industries in 1955, according to BLS labor turnover statistics, averaged 12 per 1000 employed. This was not significantly higher than the rate for any other postwar or prewar year and substantially below the rate for 1949 and 1954 periods of business downturn. The accession rate, on the other hand, was three times the layoff rate.

Rather than a net displacement of labor, a shifting of jobs from declining to new and faster growing industries has accompanied the steady growth of productivity in the past. Broadly speak-

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ing, the shift has been from the goods producing industries—agriculture, mining, manufacturing, and construction—to the service industries—transportation, utilities, trade, service, finance and government. Employment in goods producing industries was only about one million higher in 1955 than it was in 1919, but employment in service industries more than doubled, from about 14 million to nearly 30 million. In 1955 the service sector actually employed one million more persons than the goods producing sector.

With greater mechanization, the importance of the machinery producing industries has also significantly increased in relative importance. Employment in electrical (including radio and television) and non-electrical machinery industry groups increased by 157 percent between 1939 and 1955 compared to a 64 percent gain by manufacturing as a whole.

EXPANDING ECONOMY REQUIRED

It seems clear that the general availability of jobs for workers displaced by new technology, in the first place, is part of the larger problem of fostering an expanding economy. The Subcommittee of the Joint Congressional Committee on the Economic Report stated that its "best and by far the most important single recommendation . . . is that the private and public sectors of the Nation do everything possible to assure the maintenance of a good, healthy, dynamic and prospering economy, so that those who lose out in one place as a consequence of progressive technology will have no difficulty in finding a demand for their services elsewhere in the economy."

Displacement, even in generally favorable economic circumstances, may mean readjustments and hardships for individuals that call for thoughtful action. Where technological change eliminates jobs in particular operations of an expanding plant, (possibly the typical case today) workers may be transferred, often at the same wage, and after training by the company, to operations not subject to extensive mechanization, such as assembling, maintenance or shipping, or to new jobs created by new techniques.

Labor saving in a plant that is contracting its total employment, on the other hand, may mean layoffs with serious losses to workers of wages and fringe benefits, seniority and its associated benefits, and the value of plant experience. The most critical situation is, of course, the closing down of an entire plant which is the mainstay of a community's economy. Reemployment for these workers often involves complex problems of relocation and retraining. Workers who face special difficulties in obtaining jobs—older workers, women, Negroes and physically handicapped workers—may be most adversely affected by technological change.

BENEFITS OF PLANNING

In contrast to the 1920's, there is very wide attention being paid to the plight of workers displaced by technical change. Few assert today that the unemployed worker must rely on his individual resources only. Under the Employment Act of 1946 both the Legislative and Executive branches of the Federal government are commited to adopt policies to maintain a high level of employment. More concretely, the displaced worker today has unemployment insurance to tide him over financially and free placement services to help him find a job quickly. Congress is now considering special programs to assist distressed communities. More attention no doubt will be directed to the adequacy of these services in relation to the problem created by technological change.

Collective bargaining affords management and labor representatives a means of working out orderly arrangements within plants to cushion the impact of technical changes on workers. As automation progresses, unions and management will be concerned more frequently with provisions for dismissal pay, guaranteed annual wages, plant and company wide seniority clauses for layoffs, transfers and promotion, formal arrangements for union consultation, retraining on the job, as well as labor's traditional call for a share in the gains of productivity through higher wages, fringe benefits and shorter hours.

Good illustrations of ways management, by advance planning, introduced automation without serious dislocation of its workers are presented in two case studies recently published by the Bureau of Labor Statistics. A large and growing insurance company, which had suffered a shortage of clerical labor installed an electronic computer for record processing, and eliminated a number of clerical operations. Since it took about two years to install the computer, the company was able to plan carefully the transfer, reassignment and retraining of the clerks, and made the change without laying off any worker.

A somewhat similar situation was found in a radio and television manufacturing company that had introduced printed circuitry and automatic assembling machinery. The company eliminated a number of hand assembly jobs on which women worked and set up a number of higher paid jobs for operating machinery. Since the company timed the change for a period of seasonal expansion and company growth, no one was laid off. All job changes were made according to the seniority and work rules of the union agreement. In short, by anticipating the effects of automation, management and labor can often make plans to alleviate any adverse effects on the people involved.

So far as the occupational changes implied by automation are concerned, exact information in this important field awaits further research. Nevertheless, some observations based on past trends and fragmentary reports of current tendencies are revealing.

Broadly speaking, mechanization and mass production have reduced opportunities for unskilled workers on heavy arduous physical labor, whether on the farm or building site, in the mine, or in the factory. The jobs of skilled handicraftsmen or artisans—the cigar maker, glass blower, cordwainer—have been transformed into machine operations, with semi-skilled workers performing simple, repetitive tasks. New skilled occupations of the machine age—tool and die maker, electrician, machinists—also require long training and a high degree of manual dexterity, but are not longer closely identified with a single process or product.

OCCUPATION SHIFTS

Census statistics on occupations chart these changes. The most numerous groups of workers in 1950 were the semi-skilled and clerical and kindred who make up 43 percent of the work force, compared to 25 percent in 1910. This group now holds the position of importance formerly held by unskilled laborers and farmers who were 20 percent in 1950 compared to 45 percent in 1910. The skilled worker group held its own over the 40 year period, comprising about 13 percent of the total. One other noteworthy change is the increase

CHAPTER PERFORMANCE AWARDS REPORT

For Period of July 1, 1955 to February 29, 1956

Hudson Valley	7311	Northeastern Penna.	4307
Knoxville	6424	Clearing	3986
Lancaster	6216	Dallas	3913
Providence	6179	Saint Louis	3724
Greensboro	5794	Lehigh Valley	3722
Indianapolis	5741	Baltimore	3701
Cleveland	5700	Richmond	3662
Philadelphia	5665	New Orleans	3587
New Haven	5541	Worcester	3561
Wilmington	5423	Montreal	3136
Tren.-Del. Val.	5314	Portland	2993
Raritan Valley	5301	Madison	2867
Milwaukee	5247	New York	2836
Boston	5147	Georgia	2009
Western N. C.	5034	San Francisco	1960
Bridgeport	5008	Cent. Penn.	1737
Nashville	4986	Western Mass.	1538
No. N. J.	4926	Central N. Y.	1512
Binghamton	4921	Detroit	1337
Sacramento	4836	Athens	454
Reading	4834	Calumet	
Pittsburgh	4831	Charlotte	
Twin City	4686	Cincinnati	
Chicago	4588	Dayton	
Kansas City	4557	Fox Valley	
Washington	4543	Hartford	
Los Angeles	4503	Northern Ala.	
Alabama	4407	Puerto Rico	
Columbus	4352	Stamford	
Greenville	4351		

in the proportion of professional persons, from 4 percent in 1910 to nearly 8 percent in 1950.

Automation now points to a continuation of this tendency to upgrade jobs in different areas than in the past. Thus, the group to be most affected by displacement is the numerous semi-skilled class of machine operators, machine watchers, routine assemblers, and clerical workers, whose job consist of performing repetitive motions of feeding or manipulating machines. Such jobs have been simplified and routinized to such a degree that electronic computers, material handling equipment or automatic control systems are being adapted to do them.

CREATION OF NEW JOBS

Industry is now seeking, on the other hand, versatile skilled workers and professional engineers for custom producing and installing complex machinery, and for industrial research and development. Entirely new clerical occupations —analyst and programmer—are opened up by the application of electronic computers to business operations. In short, many monotonous tasks of mass production, while not eliminated, are becoming relatively less important. Jobs requiring the exercise of judgment are becoming relatively more numerous.

Some evidence of these changes has already come to light. At Ford's Cleveland and Dearborn automated engine plants, according to D. J. Davis, Vice President, fewer persons were directly engaged in production in 1954 than in 1950, but the number of skilled maintenance personnel was increased. In the telephone industry, the number of maintenance, professional, sales business office and clerical workers increased between 1945 and 1953 considerably faster than the number of operating employees. In the chemical industry, automatic equipment requires the greater use of the maintenance skills of machinists, pipefitters, electricians and instrument men.

STIMULUS TO TRAINING

The ramifications of these manpower problems are far reaching, touching on many activities of government, labor and management. Assuring an adequate supply of skilled workers for the technology of the future means increasing substantially the number of workers taking apprenticeship and other on-the-job training. The Department of Labor's Bureau of Apprenticeship is now seeking to expand the number of joint labor-management programs and to induce more workers to enter and keep up the long-term training.

One of the most important problems, perhaps critical for the progress of automation itself, is filling the greater demand for "creative manpower" to use J. Douglas Brown's term, in management as well as technical work. Automation intensifies the demand for engineers and scientists, of whom there is already a national shortage. A new occupational group—the engineering technician—is becoming increasingly important for designing, installing and servicing electronic and other complex equipment. Having some of the manual skill of the craftsmen and some of the specialized training of the engineer, the technician serves as liaison between the worker and the professional.

It is increasingly recognized that the shortage of engineers and scientists is not only a problem of training more students at the college level but involves the adequacy of high school training where fundamental skills in science and mathematics are begun. Moreover, it concerns the recruiting and training of teachers as well as of students. Fundamentally, perhaps, it involves such intangible factors as the motivation of young people in selecting careers and the nation's willingness to spend money for education.

The shortage of trained personnel also underscores the need to utilize persons on the job at their highest professional capacity. With mass employment of engineers, wasting engineers on tasks that could be done by less skilled persons becomes costly to the firm as well as demoralizing to the individual. Moreover, with skills so short, we can hardly afford discrimination in the employment of any group on account of age, sex, or race. A more "human use of human beings" involves improved human relations among supervisors and workers as well as the technology of automatic controls.

Since developing skill and knowledge for automation requires individuals, firms and government to invest in longer and costlier training, more advance planning of manpower programs becomes essential. A first step, no doubt, is continuing research on the progress of automation and its implications for labor displacement, occupational needs, recruitment, training, and industrial relations. It is noteworthy that on this issue witnesses from management and labor before the Congressional hearings on automation were in accord.

LABOR DEPARTMENT STUDIES

Since many of these areas are interests of the Department of Labor, this government agency has assumed an active role in this field of research. The Department's Bureau of Labor Statistics is now making a series of case studies of plants introducing automation covering various labor aspects of a changeover, bringing up to date its Occupational Outlook Handbook, a basic source of guidance information, and improving its productivity and labor turnover statistics. The success of these research programs, to a great extent, depends on the voluntary cooperation of industry officials in all parts of the country.

Clearly, the programs of automation creates new opportunities for attaining goals valued by the American people: more goods and leisure, better working conditions and opportunity for self development. At the same time it raises complex problems that impose new responsibilities on management, labor and the government. There is every reason to believe that Americans of good will can find ways of realizing more fully automation's potentialities for advancing human welfare. ■

Contrasting the long run benefits to be anticipated from automation with the difficult short run dislocations, the author suggests various changes which may help our society and economy to assimilate marked technological developments during the next decade. Among these are a shorter workweek, improvements in unemployment insurance and social security, planned employee retraining, earlier retirement policies, and widened seniority provisions. He urges the necessity for joint discussion and cooperative planning by labor, management and government to ease the impact of automation.

Labor Views Planned Adjustment to Automation

By Nathaniel Goldfinger
Economist, Department of Research
American Federation of Labor-Congress of Industrial Organizations

THE widespread introduction of automation in the years ahead poses many potential problems of adjustment for the American people.

Technological change always has some degree of social and economic impact. The long run benefits that flow from new and improved tools and production processes are readily recognized —increased productivity, new and better products, the basis for improvements in living conditions, national strength and in leisure. The shorter run problems of adjustment that directly affect workers and may have adverse effects on entire industries, communities or the nation are frequently ignored.

The introduction of new and improved machinery of a conventional type into a plant often displaces workers from their jobs, makes skills obsolete, and makes changes necessary in job content, job classifications and wage structures. The degree of impact from such technological change may be slight, the number of people involved may be small. But it must be underscored that even such mild impact is real for the workers directly affected and for their families.

What kind of impact may be expected from the widespread introduction of a radical technological change, such as automation? Will the transition be accompanied by social and economic dislocations? Will the economy expand rapidly enough to adjust to sharp rises in productivity without the large-scale displacement of workers and increasing unemployment? Will society provide shock-absorbers to minimize the potential difficulties? These are some of the questions working people are asking about automation. They are an indication of the problems with which unions are grappling.

No one can tell us precisely how fast the new technology will be introduced. It is rather clear, however, that many basic sectors of our economy—entire plants, offices or departments—will be using automation equipment a decade from now.

There is a possibility that the widespread introduction of the new technology in the coming decade, and continued improvements in conventional productive techniques, may result in the displacement of many thousands of workers. This possibility cannot be gainsaid by complacent assurances that all will work out well in the long run. Man is mortal and, in the long run, as Lord Keynes once said, we're all dead. There is also the memory of the Great Depression of the 1930's, which, in large part, was the result of the economy's failure to adjust to the spread of mass production techniques after World War I.

Even if automation is introduced more slowly, and if large-scale displacement does not occur, there is a possibility that the economy may not expand with sufficient rapidity to provide job opportunities, during the transition period, for new entrants into the labor force. Many firms that have introduced automation equipment in recent years boast of having adjusted their workforces, without lay-offs, but without hiring new employees. Within the next

NATHANIEL GOLDFINGER

Since obtaining his B.S.S. degree from the College of the City of New York in 1938, Nathaniel Goldfinger has done research, economics, and educational work for unions. Starting as Associate Director of Research of the United Paper, Novelty and Toy Workers International Union, he became Director of Research and Education of the United Paperworkers of America, Associate Director of Research of the National CIO and Secretary of the CIO Committee on Economic Policy, and is now Economist in the Research Department of the AFL-CIO. He has done graduate work at C.C.N.Y., New York University, the New School for Social Research, and the American University, and is a member of the American Economics Association and Secretary of the Washington Chapter of the Industrial Relations Association.

few years, the labor force will feel the effects of the rising birthrate since 1939. More young people will be looking for jobs than in recent years. Will there be job opportunities for these new entrants into the labor force, or will they be compelled to serve their apprenticeships as unemployed job-seekers?

Our society and economy can adjust to the spread of automation with a minimum of disruption during the years of transition. But such adjustment will require rapidly growing markets, as the basis of an expanding economy whose productive efficiency is improving sharply. It will require a continuing balance between our ability to produce and our ability to consume.

These adjustments will not come automatically. Organized labor is too realistic to believe that there are feedback self-adjusting market mechanisms to immediately provide job opportunities for new entrants to the labor force, as well as for workers who may be displaced. As productivity increases rapidly with the introduction of automation, consumer purchasing power will have to rise rapidly, too. And that means substantial wage increases, improved fringe benefits, guaranteed wage plans, and a sharing of the benefits of reduced production costs with consumers through lower prices, wherever possible. The length of the work-week will have to be reduced to a 35- or 30-hour week, a 2½- or 3-day weekend. It also means the necessity of improvements in the unemployment insurance and social security systems, government full employment policies and government assistance to communities that may be distressed through plant migration or declining industries.

TRANSITION DIFFICULTIES

To the wage or salary earner, automation promises, in the long run, to eliminate routine, repetitive jobs and to improve working conditions. But, in the shorter run, during the transition period, it promises to raise countless problems of adjustment.

What of the worker who is displaced from his job or whose skills are made obsolete by automatic equipment. It sounds good to say, as did one industry spokesman, that "the hand trucker of today replaced by a conveyor belt, might become tomorrow's electronics engineer." But how does the hand trucker become an electronics engineer or a skilled technician? If automation destroys unskilled and semi-skilled jobs, means must be found to train workers in the needed skills. Management must assume a significant share of the responsibility for retraining workers and government, too, must provide vocational training facilities.

RETRAINING PROGRAMS

A retraining program will have to make provisions for the needs of the workers. Most of them will be mature people to whom learning new skills may not come easily and they will have to live and support their families while they acquire new skills. Provisions for retraining allowances will have to be made, as well as provisions for training facilities and instructors. If management and government fail to provide such training programs, there may be a job as a skilled technician for the hand trucker's son, but the hand trucker, himself, may become permanently unemployed, scrapped along with the obsolete machines.

While there is much talk and general agreement about the upgrading of skills, in the long run, with the introduction of automation, there has been a tendency to ignore a real possibility of downgrading the skills and wages of many employees in the present workforce. What of the payroll bookkeeper whose skills are made obsolete by an electronic computer? If he is retrained —or sees to it, on his own, that he is retrained—shall he accept the reduced salary and title of a statistical clerk? Collective bargaining can develop some means of alleviating such a condition, as many clerical workers will probably discover in the coming decade. Although the answers to such problems will have to be worked out by the parties on the basis of specific circumstances, one possible avenue lies in maintaining the bookkeeper's salary, although he may work on a lower-rated job, so long as he remains with the firm. Similar procedures have been developed in industrial plants, in connection with job evaluation plans that may call for cutting the wage rate on a job.

Solutions will also have to be found for older workers who may be too old to adjust to the demands of the new technology. Shall a 60-year old worker be tossed on a scrap-heap because he is too young to retire and too old to learn new skills? Here, too, collective bargaining can provide some of the answers. Earlier retirement provisions in negotiated pension plans would be helpful. But most often, workers cannot live on the small allowances of private pension plans alone. The Social Security Act will have to be amended to provide earlier social security payments for workers who are forced into retirement before they reach the age of 65.

It may be necessary to make many changes in the terms of collective bargaining agreements. New job classifications and wage structures will have to be developed, as automation changes job content. Job evaluation plans may have to be thoroughly revised or discarded. The new technology may make wage incentive systems obsolete.

Seniority provisions in collective bargaining contracts may require changes, as the departmental structure of the

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firm changes. Equitable seniority protection for workers may make it necessary to broaden seniority areas to plant-wide or company-wide seniority. Some thought is being given to the possibility of geographic area-wide preferential hiring; all firms, under contract with the union, would give preference to laid-off workers in the same industry and area.

As the new technology speeds up the rate of rising productivity, substantial improvements in wages and fringe benefits, and a reduced workweek, will be necessary to spread the benefits of reduced production costs to the great mass of American families.

These and numerous other problems that likely will arise with the spread of automation are a challenge to management.

Will management be sufficiently social-minded, however, to carefully plan for the introduction of automation in order to minimize the job and income losses of employees? Will management meet with organized labor around the bargaining table, in good faith, to work out solutions to the problems that arise?

SOCIAL-MINDED PLANNING

The prospect of labor displacement and disruption of the workforce, for example, can be eased, in part, by joint consultation between companies and unions and by management planning to schedule the introduction of automation in periods of high employment, to allow time for the retraining of employees, to permit attrition to reduce the size of the work-force. Foresight and planning will be required, however, and a willingness to see the other fellow's problems.

The management of a firm gives careful attention to changes in capital equipment. Plans are made in advance and schedules are worked out for the changes to take place. Wage and salary earners and their unions wish that advance-planning, discussions and foresight would be used by management in dealing with the problems of human beings, their employees.

The transition to the widespread introduction of automation need not cause major social and economic dislocations. Adjustments can be made without too much difficulty, if the desire is present to do so. Cooperation among labor, management and government, however, is required to get us over the hurdle of the necessary adjustments. ■

JUNE CHAPTER ACTIVITIES

CHAPTER	SUBJECT	SPEAKER	TITLE	PLACE	DATE
Kansas City	Management Problems of American Manufacturers	Dr. Allen Stockdale	National Association of Manufacturers	Saddle & Sirloin Club	6
Los Angeles	Past Presidents' Night				21
Milwaukee	Annual Fun Night			E.S.M. Building	14
Northeastern Penn.	Year End Business Report Followed by an Evening of Good Fellowship				4
Twin City	Annual Business Meeting				14
Western No. Carolina	Annual Dinner Meeting and Ladies' Night			George Vanderbilt Hotel	13
St. Louis	A Motion & Time Study Intensive Course	Gerald Nadler	Professor & Head of Dept. of Industrial Engrg., Washington University, St. Louis—*Contact for details.*	Washington University	6 through 15
		Donald H. Denholm	Chief Industrial Engineer, Chase Bag Co., St. Louis		
		Jay Goldman	Lecturer in Industrial Engineering, Washington U.		
		Gerald H. Lumsden	Superintendent of Industrial Engineering Dept., Dow Chemical Co.		
		Owen W. Miller	Instructor in Industrial Engrg., Washington University		
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"An effort to present Automation as seen from the shop level where its impact will fall hardest when it comes. It is no longer a secret that Automation will one day take over the tasks now being performed by the majority of employees in my department." From this viewpoint, the author discusses the conflict between progress on the production line and job and family security, and urges that long-range planning to resolve this conflict begin immediately.

A Shop Steward Views Automation Versus Model T's

By Edward Falkowski
Shop Steward and Committeeman
UAW-CIO, Local 365

With Automation and Robotization well on the way, we who make our livelihood on production and assembly lines may soon be regarded as outworn model T's marked by all the deficiencies of our divine Maker's imperfect craftmanship.

How will our God-given eyes ever compete with the thousand-eyed electronic-brained robot assigned to inspection work on the newly automated assembly lines? How shall we take pride in a day's work when a gadget fresh out of a foundry will outstrip any dozen or hundred of us at the same task without pause for coke or smoke? The sense of our own usefulness will recede from us and with it the sense of our belonging and participation in the world about us.

This Second Industrial Revolution is expected to do to the routine office and factory worker what the First Industrial Revolution did to the domestic artisan and the guild craftsman and the yeomanry of feudal Western Europe. An expert has already predicted possible unemployment of up to 20 millions in the short run, pending adjustments that will make everything all right again in the long run.

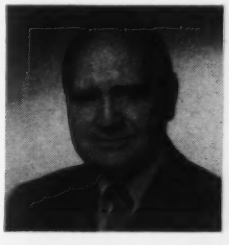
That poses a bleak prospect before Gus and Tony and Ike and Mary and the hundreds of employees I represent in my plastics fabrication industry as a union shop committeeman. Our work is precisely the standardized routine kind lending itself ideally to automation. We know that it is coming. The harbingers of the new day are already evident in the new types of automatics being installed in one department after another, machines able to turn out more production with fewer or no hands at all.

All this is progress and the instinctive feeling of the man on the production line is to give it welcome as a necessary and wholesome forward step toward something better than he has known before. Yet there is a sneaking apprehension at the back of it all, a wonder about what's going to happen to him, to his job, to his family—not in the long run but in the short run wherein we must all somehow live out our span.

One hears much talk of earlier pensioning, retirement, more leisure for those destined to be uprooted from their time-honored place in the industrial scheme. But there is more involved than this. Our culture has laid great emphasis on work as the focal point of a man's interest, not only as a source of livelihood but of his dignity and sense of belonging. This is why involuntary unemployment is so tragic. A man without work is a man without social status, without the sense of belonging.

The artificers of the First Industrial Revolution openly proclaimed their inability to grapple adequately with the human victims of their ingenuity. *Laissez faire* was made synonymous with an attitude of social irresponsibility The radical thinkers of the period took the entrepreneurs at their own word and proceeded to draw blueprints of socialist and communist utopias that continue to cast their spell over millions of people to this day. Their ideology has been a by-product of this original failure to give due heed to the human consequences of industrialization. It continues as a potent threat to our way of life.

The Second Industrial Revolution



EDWARD FALKOWSKI

An anthracite mineworker at age fifteen, Edward Falkowski had two years of labor college on a scholarship from the United Mine Workers and worked in the mines here and abroad for fifteen years. He has combined free-lance writing with work in industry, is now a compression plastic molder for the Eagle Plastics Corporation, has contributed articles on economic and social problems as seen from the shop level to many publications, and is presently working on a book on human relations in industry.

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poses an even more striking challenge to management, labor and government than the First. For inherent in it is a promise of more leisure and greater abundance for all. Wisely planned and controlled, the inevitable adjustments to this new mode of production may provide the strongest argument yet devised for the way of life to which our free world is committed.

What I have found disquieting thus far has been the complacency among so many top-level thinkers. Their philosophic yawns hark back to the more blatantly announced attitudes of industrialization's beginnings. We are assured automation is no new thing but "more of the same" kind of changes that have been coming along all the time. Yet there is a point at which a rainfall becomes a flood, a wind a tornado.

I am confident we have the foresight and ingenuity and native intelligence to grapple successfully with this stupendous challenge once we get down to business. Automation can be a wonderful thing indeed. But we must not lose sight of the fact that the un-automated divinely created human model T will still most likely be around for some time and that his inner and outer needs can not long be ignored with impunity. ∎

RECENT AUTOMATIC INSTALLATIONS

Automatic Production

The General Electric Company recently unveiled what it termed "the most modern electric motor plant in the world," in which electric induction motors in the 7½ to 30 horsepower range are being produced on a mass production basis.

The new plant, located in Schenectady, and costing about $7,000,000, uses push-button controls to machine, assemble and test the induction motors. For example, an array of punch presses is situated at the start of each production line. Punching operations are fully automatic, including the feeding of sheet steel into the presses, conveying of the punchings from one press to another by magnetized belts and the automatic removal of metal scrap. Far from spelling a threat of lay-offs, automation at the plant has been accompanied by an increase in the labor force.

The plant, which employs about 600, is a monument to mechanization, speed of assembly and uniformity of production. The human hand has been largely replaced by an array of machines, beginning with seven giant punch presses producing stator and rotor laminations and ending with crane lifts that remove the finished, boxed product from its storage "pigeon hole" for shipment. With the exception of the section where the motor windings are inserted, which remains basically a direct labor operation, the assembly line is almost fully automatic. It has led to an 80 percent reduction in manufacturing time for these motors.

Automatic Handling

As opposed to the task of automation in production, which is to guide equipment through a predetermined cycle, its function in handling of materials is to move merchandise on an intermittent basis by storing random information for later use.

When the White Plains, New York, branch of Alexander's Department Store moves to a new building late this year, it will have an automated system to sort and distribute merchandise from the receiving platform to sixteen stockrooms on three floors. Already in operation is a system at the warehouse of Judy Bond, Inc., blouse manufacturing concern, which saves considerable time and labor in filling orders from inventory and assembling them for shipment. Both installations revolve around a device called DASAC — a control unit developed by the Dasol Corporation.

At Alexander's, packaged merchandise delivered to the store will be placed on a conveyor belt and hanging goods will be put on a monorail. The destination of each article is recorded on the DASAC console by pushing an appropriate button. DASAC "memorizes" the instructions and the merchandise is kicked off at the proper stockroom without further handling. At the Judy Bond warehouse, cartons of goods are picked from the storage racks and discharged at the desired station in the sequence required by the order-picker to fill shipments. The Judy Bond installation substantially paid for itself in a year, through lower labor cost and other economies.

How does automation affect the character of work? How do motivation and incentives change in the automatic factory? What are the effects of automation on supervisors, management, and unions? Has it actually been found that automation displaces many employees in office or plant? Our current state of knowledge, opinion, or ignorance on these and other subjects is explored in this article, and the areas where industrial relations research is urgently needed are pointed out. The author's footnotes for this survey provide an excellent bibliography on automation.

A Researcher Views Human Adjustment To Automation

By Arthur N. Turner
Technology Project
Institute of Human Relations
Yale University

WHAT will be the human and social impact of automation in business and industry? How can man adjust successfully to the accelerating rate of technological change caused by automation? How will automation affect jobs and work groups and management attitudes and collective bargaining? What kinds of industrial relations research has been done and still needs to be done on the effects of automation?

There has been a great deal of talk and "special interest" argument about these questions, but not enough concrete evidence and far too little research. Specific case examples of the impact of automation on people were discussed by representatives from business organizations, labor unions, and universities at the conference on "Man and Automation" sponsored by the Society for Applied Anthropology at Yale last December. This article will draw on the proceedings of this conference as well as on other studies, in order to describe the significance of automation and its effects on the following features of business and industry:

- Job content, level of skill and interest — qualitative labor requirements
- Group structure and relations
- Motivation and incentives
- Supervision
- Management
- Collective bargaining
- Displacement — quantitative labor requirements

It has been rightly emphasized that automation has several separate aspects. In the words of one authority, "Too many people overlook that automation is a three-legged stool: the leg that is highly engineered mechanization, the leg that is feedback or closed loop control, and the leg that is the electronic computer. Too many things said about automation as a whole are applicable to only one of the legs, and too many arguments based on facts about one leg tend to ignore the other two."[1] (See Footnotes at end of article.)

A good *general* definition of automation is that of Milton Aronson, editor of *Instruments and Automation,* who calls it "the substitution of mechanical, hydraulic, pneumatic, electric, and electronic devices for human organs of decision and effort."[2] The substitution of these devices, (with the exception of electronic devices) has been going on for a very long time. But most authorities would agree that the new element, which justifies the coining of a new word, is the automatization of control and *decision making* functions.[3]

Another justification for the use of a new word to describe this latest phase of technological progress is that it warns us not to assume that its economic, social, and human *effects* will necessarily resemble the effects associated with mechanization in the past. As a matter of fact, there is already considerable evidence that automation often will *reverse* trends which past experience has taught us to expect from technical innovation.

For example, to the economist[4] the first industrial revolution brought about a shift from indirect costs to direct costs, so that a large share of total cost could be varied directly with the level

ARTHUR N. TURNER

Pilot in the Navy during World War II, Arthur Turner then obtained his B.S. degree from Yale and his M.B.A. from Harvard Business School. Since 1951 he has concentrated on industrial relations research on the Technology Project at the Yale Institute of Human Relations. He is author of many articles in this field, and co-author with C. R. Walker and R. H. Guest of *The Foreman On The Assembly Line,* an examination of the role of the mass production foreman, published by Harvard University Press last month.

of production. However, this trend has now been reversed. Especially with automation, the proportion of direct labor cost to total cost is decreasing. More labor is becoming indirect, that is, maintenance, technical, supervisory people who are less easily laid off and hired as production fluctuates. Furthermore, with increased investment in automatic equipment, labor costs including indirect labor will become a smaller proportion of total costs. Under these circumstances it is clear that an economy made up of units with increasingly high fixed costs may behave quite differently, and that assumptions based upon an era of predominantly variable wage costs may have to be re-examined.

JOB CONTENT

How does automation affect the nature of jobs, the level of skill and interest? Here again there may be an important reversal of the past trend. Under mechanization in the past an important source of dissatisfaction at work has been that jobs have often become routine and monotonous for many people.[5] Recently there has been a recognition that job simplification may have reached a point of diminishing returns and some managements have consciously sought to make jobs more interesting.[6] Whereas in the past efforts at "job enlargement" seemed to be opposed to technical progress, with automation this may no longer be true.

Automation *may* reverse the trend in the direction of job enlargement. There is no assurance that it will. Predictions about the future often claim that automation will bring about a tremendous upgrading of jobs.[7] But some studies based on concrete present examples of automation report little or no upgrading, and in some cases show that less skill is required on the automated equipment.[8]

In the case of office automation, users and manufacturers of electronic data processing equipment state that the effect on clerical jobs is to raise the skill required.[9, 10] Research studies of computer installations present conflicting evidence on this point. For example, a study now in progress in a public utility by the Survey Research Center of the University of Michigan shows considerable job enlargement and decrease in specialization.[11] On the other hand in a detailed case study of an installation in an insurance company it was discovered that there was an increase in job content for only five of twenty employees assigned to the computer, and no real increase in skill for the other 56 people who were retained on auxiliary but non-computer duties, (although many got increases in pay).[12]

In this particular case there were also nine analysts and programmers involved (eventually there will only be four), whose jobs required considerable skill and specialized training. As far as office automation in general is concerned, the demand for skilled analysts and programmers will be very great. One estimate is that within the next decade there will be a need for 170,000 people "with professional status" to analyze and program data for the computers which will be installed.[13] This work is painstaking and very detailed, requiring not only special training but also a special kind of personality and intelligence. For this reason computer manufacturers are conducting extensive "programming research" in order to simplify analysis and programming procedures.

In short, the total impact of automation in the office will probably be in the direction of job enlargement eventually, but it is a mixed and confusing picture at present. The same can be said about the effects on job content of automation in the factory; here again more research needs to be done before accurate generalizations can be made.

In one study of an "automatic" steel mill most jobs required different skills and less physical effort. At first the men felt apprehensive at the scope and unfamiliarity of the new equipment. For several months, they disliked having to be constantly on the alert in case something went wrong. Eventually, however, they expressed considerable satisfaction with their jobs and pride at having learned to control the equipment and operate it successfully.[14] Furthermore, if the mill had been completely automated, the constant watching might not have been necessary or could have been performed by automatic scanning and control devices instead of by men.

REVERSAL OF TRENDS

Here perhaps is another example of how true automation could reverse a familiar trend. In the past mechanization performed more and more physical work, leaving sensory and routine decision-making processes to men. These are the processes which man is not necessarily very good at, because they require constant alertness and yet lack intrinsic interest or variety. Yet it is exactly these monotonous and tension-producing functions of sensory perception and the yes-or-no type of decision making which automation can replace.

GROUP STRUCTURE AND RELATIONS

Another area in which more information on the impact of automation is needed is its effects on groups and group structure within office and plant. Industrial relations research has repeatedly pointed to the importance of group relationships at work, but so far we know very little about the possible impact of automation in this request. Clearly in many cases existing groups are disrupted or reorganized as a result of the installation of automatic equipment. Sometimes in the factory automation may have the effect of making any "group" in the usual sense impossible because workers will be too far apart to communicate with each other. In other cases automation will increase the degree of teamwork required by the job.

Research to date has shown that often resistance to technological change is not so much to the changed technology itself as to changes in the pattern of interpersonal relationships which the technological change makes necessary. For managers concerned with helping people accept and welcome new equipment and new procedures, it becomes very important to understand the various possible impacts of technology upon individual and group relationships.[15]

In one respect it is certain that automation increases the importance for management to think less in terms of the individual and more in terms of the group; namely, in respect to incentives. Under most forms of advanced automation, individual piece work incentives make little sense. This holds for a number of reasons, the most obvious of which is that the individual operator will have less direct control over the rate of output. As successful operation depends increasingly on design, engineering, maintenance, and management, the contribution of any one individual to production rate and quality will become impossible to measure.

It would seem that each individual involved will share with all others a general responsibility which in many cases will cut across traditional department lines. Organizations which want to preserve monetary incentives will have to do a lot of thinking and experi-

menting with various forms of plant-wide incentive systems and profit-sharing plans. Even without automation there is evidence enough to raise serious questions about the traditional assumption underlying individual piece work systems.[16] Automation will make it still more necessary to dispense with some of these assumptions.

Automation will also increase the importance of non-financial incentives. With a high capital investment per worker, and in some cases a high degree of understanding about the whole operation necessary, motivations such as loyalty to the total undertaking and interest in the job will become increasingly essential. In more cases than before successful production depends less upon skilful direct manipulation of material and tool, and more upon effective human collaboration. "Increasingly . . . the production employees are engaged in communicating with each other concerning what the equipment is doing and maintaining the proper relationships between intricately coordinated machines. Work becomes more abstract, more complex, more intellectual . . ."[17] These circumstances will seriously threaten the traditional assumption of some members of both managements and unions that direct financial incentive is the only effective motivation.

VALUE OF BUTTON-PUSHING

Automation will also require some rethinking of the assumptions upon which job evaluation and wage classification have been based in the past. In some instances management has voluntarily raised wage rates because of the increased importance and responsibility of the new job even when the skill required, in the traditional sense, has not increased.[18] And unions have been quick to make public their view in this respect. For example, the United Automobile Workers have pressed for higher job classifications when the job is upgraded in terms of responsibility and value of equipment operated, even when it is also downgraded in terms of effort and skill.[19] Will management agree with this principle?

In some examples of automation, as Bright pointed out in the article cited above, there is "literally . . . nothing for the worker to do but 'push a button' or 'monitor' the machinery. . . . In two plants, management advised that one of its major mistakes had been to overestimate the technical requirements of certain jobs."[20] And some managements will admit to having made the same "mistake" in the case of office automation. Yet the fact remains that in most cases a failure to "push the right button" at the right time can be extremely costly, in relation to the expense of a "logically" unjustified increase in wage rate. Where this same watching and waiting type of job lacks intrinsic interest, management may find itself paying for the ability to put up with long periods of tedious but alert inactivity.[21] And the importance of such motivations as a man's interest in the intricacy of the process and pride in his ability to control the complicated equipment placed in his charge, may require training in the technical operations of new equipment even when such knowledge is never called for in the normal course of the job. It may become increasingly important to have operators know what their equipment does whether logically they need this knowledge on the job or not.

ROLE OF SUPERVISORS

In the future as in the past it will be the role of the supervisor to encourage operators to feel loyal to the total undertaking and actively interested in the job at hand. Yet so far very little is known about the impact of automation on the foreman's or supervisor's job. There is usually a decrease in the number of operations supervised by each foreman. In some extreme cases direct labor is eliminated altogether, so that the former production foremen become in effect the operators of the new equipment.[22] Such a "foreman" has to acquire totally new technical skills and knowledge in order to understand his equipment and to help supervise maintenance operations.

Usually the changes in the foreman's role have been less radical but almost inevitably in the same direction: fewer production operators supervised, more technical and maintenance knowledge required. Yet the importance of the foreman's administrative skill may increase along with the necessity for increased technical knowledge. The chemical and petroleum refining industries have long lived with the problems sometimes caused by an emphasis on technical at the expense of human skills in supervision.[23] Some organizations may want to experiment further with the idea of functional supervision, separating some of the technical from the human and administrative responsibilities.

Any installation of new equipment and new ways of operating puts a strain on human relations and requires a high degree of administrative skill and human understanding on the part of supervision.[24] "Administering changes" takes time, and yet a period of technical change is often just the period when supervisors feel that not enough time is available. Sometimes the changes are more difficult for supervisors to accept than for workers.[25] Supervisors may feel that their established ways of thought and behavior on the job are threatened; they will worry about their future role. Just as it is important for supervisors to understand their men's reactions to technical changes, so it is equally important for upper management to take into account supervisors' possible reactions. In both cases the resistance, when it appears, is likely to be not only to actual changes in the job itself, but also to the resulting changes in an established pattern of human relationships. In both cases resistance will be minimized when superiors share with subordinates the planning and reasons for the change, and when all the effects are openly discussed by all concerned beforehand.[26]

Essentially a readiness to accept technical changes, and in a way which does not arouse resistance, starts with management. Resistance to technical changes can be a barrier to progress at every organizational level, including the top. Yet it is not enough for upper management to be enthusiastic about changes; management has to know how to make its enthusiasm contagious, how to have the *whole* organization "prepared and organized for change."[27] Also management has to be able effectively to resist those proposed innovations which upon analysis turn out to be merely change for change's sake.

MANAGEMENT ATTITUDES

Above all, the degree of resistance to change depends upon management's point of view, and willingness openly to share its ideas and plans; an ability not just to "sell," but to *listen.* One company president extemporaneously described his point of view as follows: "We have a great responsibility for improving communications. . . . There are lots of techniques for doing this, but none excels that of simply explaining to everyone what you're trying to do.

. . . When we introduce new processes and new ways of doing things, . . . if these things are all discussed in advance, it gives management a chance to know all of the problems that are involved and in some ways to answer them. . . . I have great faith in the common man's ability *to keep management from making mistakes.* . . . It's two-way communication. . . . In essence it means that the people must understand what management is trying to do, and have a chance *not only to understand it but to question it* and its advisability and motivation; and it's been my experience that once the thing is clearly understood, most of these difficulties that arise after the change can be eliminated.[28] (Emphasis added.)

Much has been made of the fact that to install automation in any process requires a basic "rethinking" of the nature and objectives of the process in order to obtain all the potential benefit which automation can bring.[29] Particularly in the case of electronic data processing much more has been written than has yet been accomplished in performing complex new functions of analysis and control.[30] Apparently experience with the large computers to date has mostly been confined to performing at much greater speed and with less labor the same data processing functions which were being performed previously with punched card equipment. Eventually the impact of computers, perhaps special purpose analog computers, upon the over all control function may be very great indeed. But most opinion is that this development is still a long way off.[31, 32]

PSYCHOLOGICAL UNFREEZING

However, on a more limited scale, any installation of electronic data processing provides an important stimulus to management to reexamine and revise existing procedures. The planning and procedure analysis which precedes the installation has been described as a "psychological unfreezing of a situation," a period when a lot of improvements that could have been made before finally get made.[33] In some cases the gain from reorganizing the functions which the computer would take over have been so great that the computer has, so to speak, "worked itself out of a job" before the installation was ever made. This raises a number of intriguing research questions, not only concerning how the management adapts to such organizational changes, but also concerning why it sometimes takes the impending installation of a major technological change to stimulate organizational and procedural changes which really should have been made before.

COLLECTIVE BARGAINING

Much has already been written concerning the probable impact of automation upon collective bargaining.[34] In general unions are not opposed to automation as such, but they are determined to "cushion the impact" upon individual workers, to influence the timing of installations so as to prevent hardship, and to press for a number of contractual provisions which, they believe, automation will make necessary. For example, the UAW pamphlet already cited, argues that automation makes necessary not only the "guaranteed annual wage" and higher pay for automated jobs, but also such contractual changes as wider seniority groupings, interplant transfers, a "living wage" to those displaced during the adjustment and retraining period, retraining at the company's expense, short-term contracts, shorter work week, and "defense of the integrity of the apprenticeable trades." Not all these collective bargaining aims by unions can with equal justification be tied in with automation; but at least in some cases it is true that changes in existing procedures will be necessary. For example, there is little question that automation will make many existing seniority groupings obsolete. Skills may no longer be transferable between jobs which were formerly related; and formerly unrelated jobs, perhaps in different parts of the plant, may now for the first time belong in the same seniority grouping as far as skill is concerned.

Research is needed not only on the impact of automation upon collective bargaining, but also on the impact of collective bargaining on automation. Will unions be able to influence the timing of the installations, and if so will the influence be good or bad for the economy as a whole? A related problem for research is the relative bargaining power of unions and managements as a result of automation and other technological change. The union in a given industry may feel itself weakened by a decline in membership, but at the same time the cost to management of a work stoppage will increase with every investment in labor-saving equipment. As direct labor becomes less important as a cost its bargaining power may increase. At least it can be said that there are some important problems in this area for industrial relations research work.

Displacement of personnel is another large and very important area for further research, about which much has been written; but so far little is actually known about the total effect of automation on employment.

Almost by definition automation eliminates certain kinds of jobs. Inevitably the effect is to produce some labor displacement at the immediate location of the installation, and in the short run. If analysis is restricted to those employed on the new equipment, it is always found that more work is being done per man hour. However, to date the result has almost never been to throw people out of work. In most cases described in the Conference and elsewhere, either the installation has been in an entirely new location, or it has been possible to shift displaced workers to other jobs for which they were equally well qualified, or to train them to operate the new equipment. One reason for this is that most installations have been in rapidly expanding industries.[34] Also, especially in the case of office automation, it has been possible for turnover and normal attrition to take care of any net decrease in labor requirements.[35]

PAINLESS TRANSITION

The situation found in the two case studies by the Bureau of Labor Statistics is fairly typical of experience to date.[36] Both companies "had a large number of women employees affected by the change, among whom a high turnover rate had always existed. Also the jobs affected were of a relatively low skill level and similar in nature to other jobs existing in other parts of the companies, offering easy transferability. These conditions, coupled with the fact that both companies were dynamic, growing concerns, greatly aided the almost painless transition into automation.[37]

In several cases so far automation has come just in time to solve serious manpower shortages. This has been especially true of electronic data processing, because large clerical employers have been finding it difficult to find and to keep the number of clerical workers required, especially when the

old jobs were highly routine.[38] And some manufacturing companies also claim that they are being forced to automate in order to meet a growing demand for their products when faced with a shrinking supply of labor.[39]

However, even under these circumstances it is not accurate to state that there has been no labor displacement. It is just that displacement has come about more through not hiring future employees than through laying off those already hired. Furthermore, there is no intrinsic reason to suppose that these circumstances will necessarily hold for all future installations of automatic equipment. There is a real need to study the impact of the displacement problem in all kinds of situations, including those in which there is little or no expansion of the total business.

The greatest need is to explore the longer run and wider scope effects of automation on employment. Unfortunately it is a very complex problem. For example, suppose one company automates the assembly of television sets and employment in the assembly department goes down; but it does not fall as much as it might, because at the same time through lower costs and a better product, the company sells more television sets at a lower price. What happens to employment in the other departments of the same company, in competing companies, in manufacturing of other forms of home entertainment, in raw material suppliers to the television industry, and, very important, in companies which design and manufacture the automatic assembly equipment? In the past increased employment and prosperity have resulted.

On the other hand, overconfidence in the long run can be very dangerous. Where the problem is more obvious, as in the case of immediate short-run displacement, people get busy and do something about it. But, when the effects are remote and less obvious and not really understood, there is the danger that nothing will be done until it is too late.[40] That is one reason why the need for study and research on the economic and social effects of this new form of technological change is so urgent.

The problems of automation will not solve themselves, but will require the strength and intelligence and understanding of unions and management, equipped with far more concrete knowledge about these problems than is now available. And the role of research in universities and elsewhere is to help supply this needed knowledge and understanding. ■

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1. *T. F. Silvey, AFL-CIO. In this and other cases where no publication is listed, the reference is to the remarks of Conference participants.*
2. *Milton Aronson: "Automation and Economics" Instruments and Automation (June, 1955), pp. 893-5.*
3. *Even here what is new is not the* existence *of mechanical (etc.) devices in place of functions formerly performed by man, but the relative and accelerating frequency of such substitutions. See for example: F. G. Kilgour, "History and Significance of Automatic Control,"* Yale Scientific Magazine *(May, 1955), pp. 6-9.*
4. *M. W. Leiserson, Yale University.*
5. *For example, see C. R. Walker and R. H. Guest,* The Man on the Assembly Line, *Boston: Harvard University Press, 1952.*
6. *C. R. Walker: "The Problem of the Repetitive Job,"* Harvard Business Review *(May, 1950), pp. 54-58. J. P. Elliott: "Increasing Office Productivity through Job Enlargement," A.M.A. Office Management Series No. 138 (1954). L. E. Davis and R. R. Canter: "Job Design,"* The Journal of Industrial Engineering *(Jan., 1955), pp. 3-6.*
7. *"In fact, automation means the greatest upgrading of the labor force we have ever seen." P. F. Drucker, "Integration of People and Planning,"* Harvard Business Review *(Nov.-Dec., 1955), p. 38.*
8. *"In several instances, a primary motive for automation was in fact to create jobs so* simple *and* easy *that unskilled labor could man them. . . . In the particular plants I studied . . . automation seemed to lower training requirements for the majority of workers." J. R. Bright: "Thinking Ahead: Some Effects of Automation,"* Harvard Business Review *(Nov.-Dec., 1955), p. 32.*
9. *Sylvia Carter, John Hancock Mutual Life Insurance Company.*
10. *W. F. Johnson, International Business Machines Corporation.*
11. *F. C. Mann, University of Michigan.*
12. *K. G. Van Auken, Jr., Department of Labor. See also U. S. Bureau of Labor Statistics, Studies of Automatic Technology, No. 2. "The Introduction of an Electronic Computer in a Large Insurance Company." (October, 1955.)*
13. *W. F. Johnson.*
14. *C. R. Walker, Yale University.*
15. *See H. O. Ronken and P. R. Lawrence,* Administering Changes, A Case Study of Human Relations in a Factory, *Boston: Division of Research, Harvard Business School, 1952; and P. R. Lawrence, "How to Deal with Resistance to Change,"* Harvard Business Review *(May-June, 1954), pp. 49-57.*
16. *W. F. Whyte:* Money and Motivation, An Analysis of Incentives in Industry, *New York: Harper and Brothers, 1955.*
17. *David Reisman and Warner Bloomberg, Jr.: "Leisure and Work: Fusion or Polarity?" Center for the Study of Leisure, University of Chicago, p. 17.*
18. *K. J. Van Auken, Jr.*
19. *"Automation—A Report to the UAW-CIO Economic and Collective Bargaining Conference Held in Detroit, Michigan, the 12th and 13th of November, 1954." Detroit: UAW-CIO Education Department (Jan., 1955), p. 16.*
20. *J. R. Bright, "Thinking Ahead: Some Effects of Automation,"* Op. Cit., *p. 32.*
21. *"Higher premiums will be required to get people to do unpleasant or dull jobs. This might be a real problem. Automation often requires a very high level person for one hour a week and somebody who is capable of doing essentially nothing for the other 39 hours. . . . You are going to have trouble keeping people from getting a kind of 'turnpike fatigue' running one of these machines." P. L. Cook, Jr.: "Social and Economic Effects of Automation,"* Twenty-First Annual Midwest Conference on Industrial Relations, *Friday, May 20, 1955. Chicago: The School of Business, The University of Chicago and Industrial Relations Research Association of Chicago, p. 10.*
22. *Such an instance is described in the Harvard Business School case "Barnes-Makroff, Inc. (c)," EA-P205, Copyright 1955 by the President and Fellows of Harvard College. In this case the work of twenty operators and two setup men was to be performed on the new equipment by "only three people—the foreman and perhaps the two setup men."*
23. *For an excellent example of these and other human relations problems in an aviation gasoline plant see the case by W. F. Whyte, "Engineers and Workers," New York State School of Industrial and Labor Relations, Cornell University, R-905.*
24. *See H. F. Craig,* Administering a Conversion to Electronic Accounting, *Boston: Division of Research, Harvard Business School, 1955, reviewed in this issue of* Advanced Management; *also the study by R. O. Rouken and P. R. Lawrence cited above.*
25. *F. C. Mann.*
26. *See Lester Coch and J. R. P. French: "Overcoming Resistance to Change,"* Human Relations *(1948), pp. 512-532.*
27. *H. F. Kneen, Safety Car Heating and Lighting Company.*
28. *H. F. Kneen.*
29. *John Diebold:* Automation: The Advent of the Automatic Factory, *New York: D. Van Nostrand (1952). In his numerous subsequent articles and speeches Diebold has effectively reiterated this point, and explained its implications.*
30. *For example see R. G. Canning: "Production Control Through Electronic Data Processing: A Case Study,"* Management Sciences Research Project *Research Report No. 30, Los Angeles: University of California, 1954. (Also available through Office of Technical Services, U. S. Department of Commerce.)*
31. *E. D. Chapple, The E. D. Chapple Company, Inc.*
32. *D. B. Hertz, Popular Merchandising Company, Inc.*
33. *F. C. Mann.*
34. *See especially G. B. Baldwin and G. R. Schultz: "Automation: A New Dimension to Old Problems." I.R.R.A. Proceedings of the 7th Annual Meeting, Detroit, Dec. 28-30, 1954, pp. 114-128. Also in* Monthly Labor Review *(Feb., 1955), pp. 165-167.*
35. *J. A. Littel, Pratt and Whitney Division, United Aircraft Corporation. Also other conference participants.*
36. *U. S. Bureau of Labor Statistics. Studies of Automatic Technology, No. 1, "A Case Study of a Company Manufacturing Electronic Equipment" (October, 1955), and No. 2, cited above. Both studies have been reproduced as Special Supplement No. 31 of the* Daily Labor Report, *Bureau of National Affairs, Washington, D. C. (Nov. 10, 1955).*
37. *K. G. Van Auken, Jr.*
38. *W. H. Johnson.*
39. *H. F. Kneen.*
40. *M. W. Leiserson.*

"Only now, with the oncoming of automation, do we begin to glimpse a future day when non-evolutional repetitive activities of all sorts may be relegated to machines and other *automatia.*" Utilizing his new concept of the industrial continuum, Professor Schell explores the implications of this development for the people working in business and industry, in an article which brings the future consequent management needs and responsibilities into sharp focus.

Industrial Continuum And The Nature Of Man

By Professor Erwin H. Schell
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TECHNICAL progress has a way of enforcing social change. Often we are not immediately aware of its influence.*

We have seen machinery replace man's brawn, man's skills, man's susceptibility to error—and now man's judgment—in the operation of productive processes; and we have seen other dynamic corrections and adjustments, such as the elimination of undue variances in work in process and the compensation for tool wear.

More and more, industrial facilities are making possible those repetitive or flow-activities which have a quality of *continuum* or, as Webster put it: "That which is continuous and selfsame; that of which no distinction of content can be affirmed except by reference to something else."

Industrial continuum has recently received impetus from one aspect of servo-mechanisms which has been nicknamed "feedback," enabling corrections for undue variations to be automatically made in the process itself.

Growing interest in these evaluative devices has overflowed into the executive and service areas and raised pertinent questions concerning other evaluative devices for the accomplishments of administrators, line officials, purchasing agents, personnel directors, chief inspectors, storekeepers and, indeed, the entire gamut of the managerial hierarchy.

I should now like to discuss some basic aspects of this growth in industrial continuum and evaluation, as it relates to the nature of man himself.

The effect of industrial continuum upon man's environment may prove to be profound. Manufacturing procedures have long had as their objectives the improving and insuring of a high quality of continuum in hand or machine operations. Stabilization of output has been earnestly sought by both organized labor and management. To this end it has been generally affirmed that evenness in repetitive procedures throughout the daily work-period and throughout the year was a highly desirable attainment.

Yet this entire concept is at direct odds with man's natural environment. The slope of the earth's axis brings the rhythm of the seasons and with them the constant pattern of climatic change throughout the year. As a result, we have for many millions of years been accustomed to "annual living," and this influence continues to dominate the interims in our lives over which we exert control. We enjoy one Christmas, one Easter, one Thanksgiving Day each year; but we would not desire two of each.

With the farmer, each day of the year is in some degree unique in its activities which are comparable only with those of identical days of preceding years.

Such variations are not found in modern industrial work-patterns; and, with the oncoming of automation, only now do we begin to glimpse a future day when non-evolutional repetitive ac-

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* *Originally presented as a paper at the S.A.M. Measurement of Management Conference, November, 1956.*

tivities of all sorts may be relegated to machines and other *automatia.*

It would appear that Nature abhors non-evolutional repetitions even as she abhors a vacuum; for wherever they are essential to human life, as in breathing, digestion or circulation, she contrives to have them take place without conscious volition.

Likewise, we discover that there are many things we may do—such as driving a car, knitting, or shaving—which we may learn to carry on without conscious attention. Indeed, it is in this area that many repetitive hand operations fall which, once mastered, permit the operator to enjoy a kind of restricted social intercourse at the workplace with a lessened sense of monotony or tedium.

It is an interesting fact that there is no place in the world where the so-called factory system has been inaugurated without some degree of tension, not to say antagonism, arising between managers and employees. Such phenomena may have their base in a subconscious revolt of the working group against the unnatural bonds of repetitive activities which have not been so rigidly required of the managing or technical group. Certainly there are many examples of loyalty and devotion to military leaders where such extreme repetition does not prevail.

INCORRIGIBLE CREATIVENESS

Industrial continuum is being heavily affected by cross-currents arising from man's incorrigible creativeness. Sweeping with ever-increasing velocity across the plains of progress, where industry is methodically striving for continuing gains from intensive analyses and steady improvement in areas of cost, quality and service, are the cross-winds of deeper and more radical change, springing from research and development. A whole new enginery of ingenuity and creativeness may abruptly engulf and transform older days and ways, as a result of the outpourings from the cornucopia of science and the arts in the form of generically new products, processes, organizations, facilities and relationships.

It may be argued that progress in those extensive and revolutional areas should take the form of a series of occasions or quanta, where forward creative surges are followed by less active periods when gains are consolidated and the rewards of intensive analysis are enjoyed. The annual model is one example of such rhythmic advance.

Industrial continuum bids fair to produce new challenges for the industrial executive. As we look across the industrial stage, with its ever-changing backdrop, its evolving prologue, discourse and epilogue, and its coming and going of human personalities, we find ourselves becoming less concerned about operating management. After all, we say, the administration of the machine, even with its modern complexities, is far less intricate than the administration of human beings, and therefore should be simpler to perform.

TENSIONS PRODUCED

Here the record is against us. The weight of responsibility for these aggregations of machinery, mechanization, instrumentation and inter-relation, with their gargantuan appetites and energies, brings tension and concern to the best adjusted personality. As one such manager remarked to me: "This is a wonderful set-up when everything is working right, but it can pile up misery at a terrific rate when it goes wrong."

Again, many of our advanced processing installations are not yet old enough to pose what might be called normal maintenance problems, the exact nature of which is often still a matter of conjecture.

As I looked at one such vast installation of automation, I asked my guide: "Have you been able to establish a beginning and an end to your maintenance problem?"

And he replied: "We are only sure of this. Every part in this great machine has a life, just as do people. Until we have determined just what these life-spans are, we will not feel that we are approaching the solution of our problem."

To me the most serious aspect of industrial continuum in relation to the operating executive lies elsewhere.

These new aggregations, with their tremendous investment, their extraordinarily sensitive coordinations and their great speed of output, are inevitably incorporating additional and incessant responsibilities that refuse to be laid aside or delegated.

No longer can we permit of a kind of management that depends solely upon periodic reports on exclusive results; for too heavy penalties may attend a lack of immediate awareness during the interim of such measurements. Operating errors in the conduct of productive procedures can quickly become lethal in character.

Little by little, the noose of evaluative control over the executive function appears to be tightening. Already, executives in operating areas are having increasing difficulty in remaining away from the job for any but brief periods. Industrial continuum is forcing us to discover just what should be the precise objectives of operating management; just how these objectives may be quantitatively evaluated; and just how these evaluations may be immediately put to constructive and preventative use. When these questions have been resolved, we shall see a fundamental change in the nature and parameter of the executive task.

Are we to allow our production executives to become enclosed within managerial routines as rapidly as repetitions are removed from the operators? If not, how are the hour-to-hour responsibilities for the new industrial behemoth to be properly shouldered?

PRESSURE ON EXECUTIVES?

Perhaps the bark of this possibility is worse than its bite. For many years the paper industry has operated with huge machines containing many self-corrective devices and costing as much as a million dollars each. Yet no great reverberations in executive conduct have been felt. Again, there is certainly nothing new in top management's attempt to judge of the effectiveness of the production-management group. But the rapid growth in consolidations no less than in automation, and the ensuing necessities for ever closer centralized awareness of operating conditions in each decentralized unit, will surely deepen the need for more sensitive and immediate methods of calipering the work and influence of those in whose hands the operating duties.

The effect of growth in industrial continuum upon the leader himself promises to be profound. More than any other member of the organization, he will be ready and eager to learn; for leadership to be earned and maintained demands a forward position in the competitive procession. Such a place can rest only upon ever-advancing knowledge of the frontiers of the industrial and managerial arts.

The president of tomorrow's industry will become acutely aware of the significance of his enterprise as a social

institution. Stability in operation and consistency in policy, as they relate to those new automated engineries, will have great influence upon the community in which his plants are situated and upon the trade with which he deals. The machine need take no cognizance of the seasons, nor of variety as such.

The president will increasingly be forced to rely upon others for counsel and advice regarding the multiplex of specialized responsibilities which surround him. To an increasing degree he will delegate decision no less than actions. To an increasing degree he will employ machinery to promote immediate factual information. To an increasing degree he, too, will measure himself against quantitative standards of accomplishment.

Most important of all, he will find it necessary to accustom himself to new and greater scales of operating magnitude. As his areas of influence enlarge in accordance with the economic growth contours of the nation, his own status will advance commensurately.

CONTINUITY REQUIRED

There is a final aspect to industrial continuum that I would stress. In today's onrushing world we may not evade the fact that an attendant function to that of increasing velocity is that of increasing uncertainty. This manifestation is becoming more evident as the days pass. For example, the query regarding "where I will be five years from now" appears to be increasing.

Unquestionably, industrial continuum will continue to bring marked changes in organization and in responsibility. No top-management may gainsay this in view of the evident nature of tomorrow's competition.

The solution is not to be found in the elimination of change. Rather we shall look to sources of support and confidence that are not affected by change. Employee goodwill and trustfulness are, in reality, reserves which are precious accumulations in any business. They are not built in a day; they are the products of time and of unvarying character. They are in the nature of resources amassed over many years of fair and square dealings.

The new problem is this. Only too frequently this trust, this confidence, this goodwill, are symbolized by a top-official who has epitomized these ideals. With his passing, uncertainty, concern and fear arise.

Somehow we must find a way whereby the high character of an industrial institution may be carried steadily and safely forward. In this day of flux, tradition is not enough. Established policies are not enough. Some new form of organization may be necessary, to insure this end.

Somehow, some way, the members of the enterprise need to be assured that, come *what* may, and come *who* may, their interests will continue to be protected by the application of the high principles upon which the business has rested.

With the expansion of our industries and the growth in continuum, we can say with assurance that any going enterprise of normal status and competence must anticipate existence which will endure long after every person now on the payroll has passed on.

THE TIDAL ONRUSH

As we try to assess the future of industry, we see dimly the new forms which it will assume under the tidal onrush of industrial continuum.

We see a decline of unnatural monotony, tedium and repetition from their past domination over the lives of many of our industrial workers.

We see the counter-flow of responsibility turning to operating management with an attendant demand for closer and more immediate evaluation of executive proficiency.

We see the powerful cross-currents of progress affecting the normal evolution of our enterprise, the merging of slow *intensive* improvement with the impact of rapid and *extensive* advance of a more fundamental nature.

We see challenges laid before leadership which call for rapid learning ability, for new manifestations of social consciousness and for ever-widening delegation of judgment and action.

We sense the need in our fluid world for testaments of honor and of character that are not the symbol of any one man, but reflect the "undying soul of the institution."

We feel the thrill of membership in a great procession moving inexorably forward into a better world.

We are certain—we are sure—that civilization is on the quick-step, marching to the ever-advancing tempo of scientific research and bowing its head in humility before the truth that shall keep us free! ∎

UNIVERSITY CHAPTER STANDINGS as of March, 1956

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Loyola University at Chicago	19
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American University	18
Roosevelt University	18
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Southern Technical Institute	15
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Michigan State College	8
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In order to have a fruitful understanding of the organization in common, the managers in a company must themselves grasp their relationships to higher and lower organization groups, serving as a well balanced liaison between them. Important factors in the managers' understanding of the organization are encouraging healthy human relations, helping to develop subordinate managers, and a clear mutual grasp and acceptance of their responsibilities and authorities. Given these conditions, a progressively improving management organization can be established.

Understanding Your Organization

By Virgil K. Rowland
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Detroit, Michigan

A MAJOR viewpoint in the understanding of an organization is the consideration of the management person. For our purposes here the term "manager" refers to any person who reports to a higher level of management and is in charge of subordinate people, either subordinate managers or non-managerial, non-supervisory people. It can, therefore, for instance, cover a range from a rank-and-file foreman or a first-line supervisor to the president of a company.

The reader should view these explanations from the standpoint of his own particular management position in his own organization, considering that section of the total company which reports to him. It is possible, then, that if he is the head or president of an organization, he might have two hundred management people under him and maybe two thousand employees; if he is a department head, he might have anywhere from seven to fifteen first-line supervisors report to him. In any case, the reader should view the following principles of organization from his own standpoint, from the job he has to do.

Every person in the management structure or organization, belongs to two groups of people; as Dr. Floyd Mann of the Survey Research Center of the University of Michigan oftentimes says, "every management person is a member of two families." One family is the higher-level management group to which the manager reports and the other family is the subordinate employee group with which the manager is primarily concerned as its leader. A manager must, therefore, talk with his superior to find out what it is he wants done and then interpret that knowledge so as to enable himself to complete the work as directed. To do so, he must then talk with his own subordinates.

A certain fundamental concept which can affect the individual's performance requires that there be a healthy relationship, understanding, communications between different levels. Actually, a manager can be something of a liaison in his dealings with the people both above and below himself; it is assumed, of course, that his own dealings with his subordinates and his superior are handled in a well balanced manner.

This basic structure—membership in two organizational families—is one of the governing factors which determines the way in which a manager performs his job. It is the factor, however, which clarifies the manner in which companies are organized and leads oftentimes logically to the charting of an organization's management team. This diagramming is only one of the measures of good organization.

The charting of an organization's structure might indicate, for instance, that a particular manager is not actually a member of the families to which he had been related. It might be found, instead, that he has a responsibility in another section of the organization and has, therefore, a different family membership. Charting of an organization's structure frequently brings such situations to the attention of those management people who are in a position to right the condition. This, in turn, makes for more satisfied management

VIRGIL K. ROWLAND

In addition to his work since 1937 as Personnel Assistant to the Vice President and Secretary of the Detroit Edison Company, Virgil Rowland has served as consultant to several departments of the government, and lectured at universities and spoken before many management groups. He has worked with Training Within Industry both at home and abroad and is well known for his furtherance of such activities as employee relations, management development, standards of performance, supervisory selection, and organization planning and training.

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people. Many managers have found that their work is done more satisfactorily when the organization setup is understood and that a clear and understandable organization results in a greatly decreased number of production delays and confusions.

A second important factor in the manager's understanding of the organization can be classed under the much-used term of "human relations." It is in this area that evidence of a healthy organization is found, for instance, in the types of communications which an organization practices, the satisfactions which employees and managers experience on and with their jobs, incentives to perform work, and the attitudes which result from such things.

PEOPLE, NOT CHARTS

All management people have definite responsibilities for "human relations." It is necessary for them to know and to do something about many things themselves, not merely to pass these things on to another person. The top man in the organizational unit is the first person who must understand that he is the principal man to handle effectively the "human relations" problems. He might "handle" them only to the extent that this is his belief, his philosophy of performance, that he accepts this responsibility and also delegates it proportionately and trains his subordinate managers adequately. Unless the top man understands this responsibility to the people in the organizational unit, he cannot understand one of the key points in the organizational picture: that an organization is not made up of squares on a blackboard or on a chart but of people, people who have likes and dislikes, abilities, satisfactions and interests as well as fears, frustrations and faults. These same things reflect back, too, to the top man, regardless of the size of the particular organization.

In understanding his job of organization, a manager must recognize that his subordinate managers have varying, effective techniques as well as personal development needs, that each man has certain fine attributes of performance which can be capitalized on as well as certain weaknesses which need to be strengthened. He must recognize that the soundness of the organization is dependent upon this capitalization and strengthening and that this improvement will be reflected to the people above and below himself. Therefore, while it follows that a manager must be aware especially of his not-too-satisfactory subordinates, it should not be overlooked that good development includes the proper emphasis on improving those subordinates who are already doing a good job. Unfortunately, a manager does not always succeed in carrying out the performance of his job satisfactorily. It might be that he has been head of a rather large organizational unit for many years. His selection might not have been a proper one. Perhaps he did not have the potential abilities for performnig the job. Or perhaps he did have the necessary qualifications, but was never given the necessary help from his own superior and so did not help his subordinates as he should have, nor did he improve the performance of his work. Certainly such an organizational unit cannot be a healthy and vital part of the entire organization, if that kind of a manager is "put up with" until he retires, or otherwise leaves the job. The person in charge of that level must understand and recognize that this man is a member of the organizational family, but that he has certain weaknesses which need to be strengthened.

TOP RESPONSIBILITIES

It is evident that these various factors which are so important to the understanding of the organization are closely related. The effect on an organization from the above-explained situation should be obvious when viewed from the family organizational standpoint. It should also be obvious when viewed from the "human relations" standpoint. Further, there is a relationship here for the top man in the organizational unit who has the ultimate responsibility for the work performance of *all* of the people in the unit. It can be seen that this same top man also has a responsibility to his superior, that he can best meet these responsibilities by continually planning for and then bringing about the needed improvements. Making no attempt to correct such matters is not fair to the organization as a whole, to the boss or to the subordinate. It is costly to the organization. It retards the development of the top man as well as reflecting unfavorably on him and it is demoralizing and deadening to the unsatisfactory manager. This same top man also has a responsibility to himself, to his own personal wants and needs in the organization. As he carries out his obligations to those people,

above and below him, he must see that his own responsibilities are also provided for. Many times this results without particular endeavor, but as a result of good family organizational relationships.

A REALISTIC APPROACH

The old bromide "take the bull by the horns" is a well-remembered point here. It takes a well-trained manager—one who understands his position in the organization—to discuss with a subordinate, as an individual, a realistic approach to an unhealthy situation which exists and which should be straightened out. One of the most frequent immediate results is the growth of the subordinate's respect for his superior. Very often, explanations and reassignments of responsibilities are a great aid to improvement. In addition to this, many of the manager's problems, interests and desires might be made known to his boss. Perhaps the manager had felt the need for more help, but had not dared to ask it from his superior. These and other similar possibilities for managerial improvement point up the need for understanding one's position in an organization.

Managers must remember that people learn what someone can teach them, but they seldom learn what someone cannot, or does not, teach them. They must look critically and periodically at their jobs and at the jobs of the people for whom they are responsible. It is a rare person who can improve in spite of his boss.

The success of each of the three previously discussed factors depends upon the amounts of responsibilities and authority that each manager has. Statements of responsibilities and authority are merely tools, or means by which a person can effectively and rightfully perform the many activities of his job to the best of his ability. The tools are given to managers by the higher management in the organization. This is one of the most effective ways of bringing about needed changes or of making certain that an organization's structure is as "clean" as it can be. A statement of responsibility and authority must provide for every requirement of the job and must have sufficient elasticity to make these tools practical and worth while.

Some organizations attempt to make clear and orderly the responsibility and authority of each manager for his particular job by using a simple device, the writing of "statements" of responsibilities and authority. This statement might be prepared by the superior meeting with his subordinate managers and discussing the various responsibilities of their jobs. Such discussions should bring out the many needs of the jobs, overlapping and duplication of duties. From the "family" relationship standpoint, these responsibilities and authority will increase in effectiveness when they are continually reviewed with higher management. It should be remembered that while every manager might need to have different technical skills, each manager has the basic responsibility of using *all* of the *tools* of management.

Once a manager becomes aware of responsibilities through his own daily practice and use of them, an organization begins to undergo improvements, adjustments or changes. Such changes often occur on a company-wide basis as well as *between* various levels in one organizational unit. For example, a manager might look critically at his job and realize that someone else on the same level has a function that does not belong to him or that is being performed in an outmoded way. If this is discussed with his boss, he might be given the assignment to study the situation and suggest a means of improvement. One thought might lead to another so that eventually the job might be changed considerably. In fact, before all of the activity from the study and recommendations is completed, a number of changes might have to be made elsewhere in the organization.

LOOKING FAR AFIELD

In looking at this over-all aspect in order to understand and to have an effective organization, there must be concern not only for the immediate bailiwick, but also for its effect on the overall organization. The top man must point out that a good job is being done in the area of changing the organizational structure. He must show his subordinate that he has vision, that he can look far afield and make suggestions that will bring about improvement and perhaps ultimately enable himself to have a broader statement of responsibility than he has. There are many other important factors, of course, but responsibility seems to be the first concern.

Line people must bear complete responsibility for their organization. They, as managers, must do their own job of management. Often personnel people have been too eager to relieve managers of their responsibility by offering to train their people or by offering to plan the organization. Some managements, too, have been eager to accept the offer whether it is from people within or without the organization. Regardless of the area—organization planning, training, or surveying—which some outsiders have gone into for management, often only minimum results have been realized. Then, too, the managers in an organization that feels it necessary to go outside its own company often do not use either all or a part of the information that the professionals supply.

ORGANIZATIONAL GAINS

On the other hand, if management accepts its own responsibility, it can expect to begin to realize many organizational improvements. Nearly every attempt will be difficult, but if undertaken in a practical way, the changes will come. Generally speaking, the second attempt will be easier than the first, and the third will be easier than the second. It almost goes without saying that managers are soon performing their jobs better, that they are more nearly doing the job for which they are being paid. Management also realizes then that most of their people, regardless of level, are doing their jobs more efficiently, that they are doing only the jobs that are necessary and that the morale of the entire organization improves.

Throughout these paragraphs, it has been emphasized that the responsibility for the proper understanding of organization lies primarily with each manager, that each manager is dependent upon his superior for the thoroughness of this understanding. In addition to this it has been stressed that there can be an effective organization only when there is a thorough understanding of it and its needs by a manager's subordinates. This is, in other words, the understanding of the organizational family relationships, the need for the practice of good human relations techniques, the necessity for the development of subordinates, a clean-cut responsibility and authority statement and the acceptance of the management job by the managerial people. These all apply to those both above and below a given individual in a management structure. ■

"No enterprise can afford to stand pat—to rely on what prevailed yesterday or exists today." Diversification is an important method for building future corporate security with the total resources available to a company. For 30 years, diversification has been a major factor in the growth of the Rockwell Manufacturing Company. Its president, W. F. Rockwell, Jr. presents the basic criteria and the reasons for planned diversification, details the significant types of diversification, and discusses adaptation and acquisition fully. His complete check list is included, which serves as a guide for points to be covered in judging specific diversification situations.

Planned Diversification Of Industrial Concerns

By W. F. Rockwell, Jr.
President
Rockwell Manufacturing Company
Pittsburgh, Pennsylvania

IN the business sense of the word, *diversification* usually is taken to mean growth that is generated in an enterprise by adding new products for new markets and seeking a stronger position in the market. This definition is accurate enough as far as it goes. However, it fails to suggest some other aspects of diversification that go deeply to the heart of a modern business concern. Among them is the capacity of the enterprise to marshal capital and brains when major changes become mandatory for, say, competitive reasons. Or, to respond to customer needs decisively and effectively with high caliber research, development and technical services. Or, *not* to be outgrown by its management executives for lack of opportunities to advance.

Over the course of about 30 years, diversification has been a predominant force in the growth of the Rockwell Manufacturing Company. Our experience may offer some useful commentaries on the subject which has come in for a considerable amount of discussion among businessmen.

Rockwell has not had direct experience with all of the methods by which diversification could be accomplished, but has followed several of them consistently and has taken a searching look at most of the others.

The result of our diversification: Starting in 1925 as a specialist manufacturer of residential gas meters and regulators, with 200 employees, Rockwell's 5400 employees now produce water meters and commercial and industrial metering devices as well, plus valves, power tools, gas and liquid regulating and control equipment, taxi meters, parking meters, and allied products which are used in most of the basic industrial and engineering fields. Today Rockwell has 20 plants in 20 communities.

By all odds the most valuable result of our diversification is our management and supervisory organization, of which naturally we are very proud. In the main it was this movement that brought together what we consider to be an able and versatile team of men and women.

This record may have in it the essence for another useful definition. Rockwell has diversified by widening and extending product lines through research and development efforts as well as by joining forces with other companies by acquisition. Either way, however, it has been the resulting enlargement of management coverage that furnished the key to success.

Our own definition, then, comes closer to these terms:

Diversification means the entry of a company into a new field of productive operations for which it can give effective management, or add new management talent as part of the transaction.

The purpose of diversification, of course, is to gain a better future performance with the *total* resources involved. And, obviously, the specific goals that add up to a better performance should be fixed at the outset.

It's a process that calls for a concerted approach, analysis, consummation and follow-through which means, simply, *planning*.

W. F. ROCKWELL JR.

A graduate industrial engineer, W. F. Rockwell, Jr. started with the Rockwell Manufacturing Company in this capacity in 1936, became vice president and controller in 1939, vice president and general manager in 1945, and has been president since 1947. He is a director of 14 other corporations. He is president of the Gas Appliance Manufacturers Association and of the Pennsylvania State Chamber of Commerce and an officer of many community service foundations and professional organizations.

The foregoing statements rest on the assumption that no enterprise can afford to "stand pat"—can not safely rely on what prevailed yesterday or exists today. If a manager subscribes to the philosophy that his job is to conduct his business *ahead of itself*, making preparations simultaneously for the day after tomorrow, next month, next year, and even beyond, then he should not fail to appraise anew the potentials of diversification.

CORPORATE SECURITY GOAL

The pattern of diversification followed by our company was established by our founder and chairman, Colonel W. F. Rockwell. He coined the term *corporate security* as we use it. It means taking good care of what *you* have and, at the same time, taking a firm hold on opportunities that promise to bring more and better results from the human resources and physical property at hand.

Regardless of the diversification methods open to a manager, corporate security is subject to the standard tests for business performance, notably the "dollar sign" measurements of costs, sales, earnings and all the rest. There are, however, other gauges. Technical leadership surely is one, and this force may be in evidence long before the figures begin to bear it out. To my mind, a number one result of our diversification program has been the technical-management leadership we have generated in the process. Two men who exemplify the point are L. A. Dixon, Sr., our executive vice president, and W. F. Crawford, one of our vice presidents. Mr. Dixon began his Rockwell career with our predecessor company and in a succession of jobs mastered all aspects of plant operations. He headed an independent company, presided over a major division of Rockwell, and now is in charge of administration for all company operations. Mr. Crawford was president of Edward Valves, Inc., when it was bought by Rockwell. He still heads the Edward subsidiary, now a more broadly-based enterprise, and has important central corporate responsibilities in addition.

Obviously a plus from diversification such as the contributions of unusually talented managers must measure out ultimately in terms of corporate security. Clearly, an unprofitable business can not long furnish security of jobs and investment, nor can it be relied upon by customers or suppliers to fulfill the ordinary commitments stipulated in the industrial market place.

Diversification is not a cure-all for a sick company suffering from management anemia, because the dose is likely to kill the patient. But for the small and large business alike, soundly conceived and well-managed diversification affords opportunities for long-term growth along with a significant reinforcement of the elements constituting corporate security.

As has been suggested, Rockwell has sought diversification in part by acquiring concerns found to be compatible with the corporate picture, but this is only part of the story. A majority of its new products and much of its versatility have been "home-made," growing out of our own research and development efforts.

Whatever the method, going into something new calls for a higher caliber of analytical planning than perhaps any other field of management. Our course of planning for diversification starts with a simple set of criteria we apply to any proposal at the very outset merely to determine whether the matter bears detailed investigation:

1. Does the venture promise long-range, continuous operations? Rockwell is not interested in "spot" opportunities or temporary advantages.

2. Are the added product lines or operations adaptable to the fields where Rockwell's experience and management talents can be applied? We subscribe to the axiom that there is enough of our own kind of business to attend to.

3. Is the venture otherwise compatible with the main lines of Rockwell's corporate procedures and policies? For one thing, we do not propose to compete with our customers.

Thus, at Rockwell we have found that opportunities for diversification can be tested initially by small and informal meetings of executives. At this stage, an affirmative finding is merely the decision to look into the matter further, investing the time and effort needed to make a thorough analysis.

DIVERSIFICATION CRITERIA

The establishment of a similar set of criteria is strongly recommended to the enterprise newly interested in diversifying itself. Like a safety program or good controllership, this essential first "screening" is invaluable for the prevention of missteps.

The process of working up a diversification appraisal and plan merits time, effort and study. Overnight judgment can not be relied on as a substitute for market studies, technical investigations of operations and products, financial analyses, conference time and, perhaps, the services of outside experts to perform a part of the fact finding. Indeed, such background may be necessary just for the initial decision of whether or not to go ahead with the idea in earnest. The appraisal may disclose that the proposition is a good one—but for somebody else.

CAREFUL PLANNING

To prescribe planning as the keystone of a diversification decision is not to say that modern management has discovered a new principle. The point is to re-emphasize the necessity of *complete* planning. In view of the complex character and the accountability of industry nowadays, all decisions seem to carry a broad range of implications: the public interest is to be reckoned with—the stakes usually are very high in terms of prospects and pitfalls in marketing—our responsibilities to the owners and to employees are so acutely realized—the human factors in business rank higher than ever before.

All of the many reasons cited for diversification bear out the principle of corporate security while achieving maximum benefits for the business through initiative and the best use of the people and resources concerned. So many good answers have been written to the question "Why diversification?", that it hardly seems useful to compile yet another statement of them. It is sufficient to mention only the main headings of the "checklist" classifications of reasons for diversification under the headings of: *Survival* (such as moves to counteract adverse market, production or materials influences); *Stability* (such as bringing productive balance to a cyclical business); *Productive Utilization of Resources; Adaptation to Changing Customer Needs; Growth,* and the inevitable *Miscellaneous* category encompassing tax advantages, reputation-building, personal ambition of the owner or manager, acquiring new management talent, and so on.

In any single instance, a number of reasons for diversification might figure importantly, but the lesser influences of others may sum up to tip the decision one way or the other. Planning assures

CHAPTER MEMBERSHIP STANDINGS AS OF April 1, 1956

New York	396	Georgia	72
Philadelphia	379	Providence	72
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Cincinnati	305	Knoxville	70
Chicago	283	Richmond	69
Lancaster	274	Columbus	69
Cleveland	266	Tren.-Del. Val.	66
Pittsburgh	242	Reading	63
Detroit	204	Alabama	62
Washington	196	Clearing	60
Boston	191	Central Pa.	55
San Francisco	169	Calumet	52
Milwaukee	160	Hartford	52
Dallas	144	Greenville	51
Los Angeles	132	Western Mass.	47
Worcester	123	Twin City	46
Indianapolis	119	Central N. Y.	46
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Montrea l	109	Charlotte	41
Raritan Valley	106	Lehigh Valley	41
Hudson Valley	102	Madison	39
New Haven	101	St. Louis	38
Binghamton	100	Athens	34
Baltimore	97	Nashville	33
Greensboro	95	New Orleans	32
Kansas City	91	Northeastern Pa.	29
Dayton	82	Portland	27
Long Island	81	Louisville	15
Sacramento	81	Stamford	15
Bridgeport	79	Non-Chapter	98
Puerto Rico	76	Non-Resident	81
Wilmington	75		

management that all potential advantages or disadvantages have been explored and appraised. Further, accountability—preparing owners, employees, customers, suppliers and others for the move, and explaining its meaning to each—is a vital part of the performance and follow-through stage. Of itself, planning generates the background and mastery needed by management representatives for communications and interpretation.

The methods of diversification also have been dealt with extensively in the business and management press. It seems to us that diversification calls for such flexibility of approach that none of these methods should be ruled out at the outset. Each diversification opportunity calls for analysis on its own merits and all methods available should be considered.

We observe that diversification programs generally work out to be predominantly one or another of the following types:

ADAPTATION: Existing personnel and facilities are employed to achieve a further diversity of products or services. This method is a "natural" in a company whose personnel is imbued with the spirit of research and development. Rockwell relies on adaptation to a considerable extent, often coupled with expansion as defined immediately below.

EXPANSION: New capacity is gained by adding to the facilities and organization, often enabling the company to go into a new product line.

ACQUISITION: A going concern already engaged in a chosen field is acquired by purchase for either cash or stock, or a combination of the two. This method has been a principal diversification method on the part of Rockwell. Because the owners and managers usually acquire an equity or career interest in Rockwell, management coverage shifts both ways. That is, central corporate functions are extended to the new division, and management skills of the acquired concern begin to figure in the over-all picture.

MERGER: A union of companies of approximately the same size and engaged in businesses considered compatible by the owners is arranged.

AFFILIATION: A participating or controlling interest in a company is acquired by another concern, but the affiliate continues to operate as an independent entity.

INVESTMENTS: Arrangements involving cash, management talents, technical skills, patents, or other resources are made so that a company may secure some direct benefits, such as an assured raw material supply or investment returns, or the benefits of collaboration. In some cases a new corporation may be formed, as was the case in the "partnerships" formed by companies going into the titanium business together.

MISSIONARY: Encouraging a supplier or customer to change, diversify or expand his operations. In a large sense, customer requirements on the industrial scene may be characterized as a great missionary force for diversification.

DIVERSIFICATION APPROACHES

The variations on such a list undoubtedly could be given at length, because each diversification situation has its own unique aspects. Of the types open to us—and we would rule none of them out of consideration—Rockwell has relied primarily on two for its diversification up to now: Adaptation and Acquisition.

Adaptation covers diversification measures which are generated within the existing resources of the concern, although an enlargement of the work force, expansion of plant facilities and other developments may result. Usually, we find, this type of diversification move centers around marketing realities or prospects. For example, our Delta division has designed, developed and introduced a metal lathe for industrial purposes and a radial arm saw primarily for home workshops, both new products complementing existing lines. The Deltashop was developed as a home workshop "package" of basic tools, ideal for individuals who wished to establish themselves in a do-it-yourself hobby, perhaps in limited space. However, the full line of more versatile individual Delta power tools now frequently replaces the combination set in home workshops as the amateur craftsman masters his hobby and tools up for more complex projects. A central body of experience in a special field enabled Edward Valves to develop the "Mudwonder" valve for oil field use, whereas its main line of activity had been in the power plant field. Similarly, Rockwell meters were developed to measure and regulate the flow of hard-to-handle liquids such as concrete and sugar syrup, one of the departures from metering devices for such household "staples" as water and gas.

ADAPTATION DECISIONS

In our experience, diversification by adaptation grows out of intensive and continuous attention to developments along the main channels of our business. Thus, the "Products Committee" of headquarters executives, including the president, consults representatives of sales, manufacturing, engineering, research, and all others whose judgments and responsibilities bear on a proposed new product idea.

The decision on a new product is based on a complete appraisal that provides affirmative answers to a sequence of questions which, in essence, are:

1. What do we know about the need? And about the product to fulfill the need?
2. Can we make it efficiently?
3. Can we sell it at a profit?

Rockwell's pattern of diversification by acquisition centers around the principle of corporate security on both sides. Rockwell has never considered allying itself with any but going concerns that would give us additional strength and talents. Because they have been success-

CIPM Reports . . .

Maynard Receives Wallace Clark Award at CIPM Luncheon

HAROLD BRIGHT MAYNARD, President of the Methods Engineering Council of Pittsburgh, Pennsylvania, was the 1956 recipient of the Wallace Clark Award for "Distinguished Contribution to Scientific Management in the International Field." The Award was presented to him by Mr. Nathaniel Mitchell, Chairman of the Wallace Clark Award Board and President of Barnes Textile Associates, Inc. of Boston, at a CIPM luncheon on April 11th.

Mr. Maynard is the third American to receive the Wallace Clark Award, which was established in 1948 under the joint sponsorship of the Society for Advancement of Management, the American Society of Mechanical Engineers, the American Management Association, and the Association of Consulting Management Engineers. In addition to developing methods engineering and other management techniques, Mr. Maynard's activities include active participation in many management societies. He has been a national director, member of the Committee on Rating of Time Studies, chairman of the General Research Committee, executive vice president, director-at-large, and chairman of the Long Range Planning and Policy Committee of S.A.M. In the international field, he has been the American representative on the Executive Committee of the International Committee for Scientific Management (CIOS), deputy president and president of that organization. Also, in 1954, he presided at the International Management Congress, Brazil.

In his acceptance speech at the CIPM luncheon, Mr. Maynard stressed today's international challenge to managers to insure world peace. He said, "The development of a new race of managers, men who can do in depth the job of improving human relations that so badly needs to be done, can be a challenge worthy of the energies, the sacrifices, the creative effort of all of us. The goal of ultimate world peace is the most important faced by mankind. We in management have a unique opportunity to make an important contribution."

Reviewing the history of American management's international activities since World War II, Mr. Maynard traced the development of the prosperity - from - production, production - from-good-management kind of thinking that did so much to put war-ravaged countries back on their feet economically and industrially, to today's realization that "there is more involved in creating lasting peace than mere material prosperity." Even though the "two-way bridge" of international management exchange is today an actual fact in many areas of the world, there is a challenge to management now that is greater than ever before. What Mr. Maynard terms the "spirit of good management" must be spread throughout the world by the "natural leaders of a large segment of our population"—the managers. The dissemination of this spirit of good management cannot be left to government and spiritual leaders alone, but is the job of everyone, everywhere. It is particularly the job of American managers, who by applying management techniques with a deep understanding of the human problems involved, both at home and in their dealings abroad, can work for the unification of men throughout the world. ■

Jane Dustan, CIPM Editor

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ful, the inclination to seek a union with a larger company grows out of business reasons of their own. As noted by one diversification-minded corporation president, "The businesses purchased often are family-owned or closely held concerns, simply because they are not popular investments with larger individual and institutional investors. Such companies often are willing to sell out because they have limited opportunity to raise permanent or long-term capital for expansion or modernization, because owners of closely held concerns face difficult tax problems, and because it is hard for them to diversify their investments."

In other words, the advantages of an acquisition extend to both sides. The head of one company which decided to join Rockwell stated it bluntly: "We're buying you," he said, referring to the shifting of investments and of careers that occur when the owners and employees accept Rockwell stock and Rockwell jobs.

Our approach to the subject of diversification always has been on a "situation" basis. Each case is studied on its own merits and all ideas of any substance are first given consideration in informal consultations at headquarters.

We have discovered that information of record and our own sources and representatives in the market furnish us with sufficient background for an initial checking of a proposed acquisition along lines of the criteria given earlier.

If the proposition is promising, we are prepared to devote considerable time and effort on the part of top management executives and staff specialists for a thoroughgoing analysis, based on a detailed check list which has evolved into its present form over a period of years (See Check List on Page 36).

When Rockwell is prepared to consider an acquisition in earnest, representatives of the other concern are of course given every assistance in their own analysis of our company. At this point a mutual resolution has been formed to size up one another in terms of what each offers to the other. A complete exchange of information is essential for the negotiations that follow an affirmative agreement in principle. And, equally important, it constitutes the groundwork for integrating the new unit into the Rockwell picture.

We can attest to the values of an aggressive diversification program because it guarantees an open mind whereby all opportunities and good ideas are, at least, given some consideration. Because our diversification has been planned around the objective of corporate security, the decisions we reach are tempered by a reliable process of planned analysis. We believe there are other values as well. Not the least of these is the awareness generated within the company of its own character and qualities as others assess them. We have been enabled to see ourselves as others see us—and, in these days when the effectiveness of an enterprise depends in large measure on its standing with constituent groups such as owners, employees, customers and suppliers, the ground rules for sound diversification apply with equal force to the general conduct of the business. ■

(See *Diversification Check List* on Page 36.)

Diversification Check List

This check list has served usefully as a guide or reminder of points to be covered, when applicable, in preparing detailed background for judging a specific diversification situation.

A. General

1. Statement of proposed transaction and objectives.
2. History of business and general description.
3. List of officers and directors; affiliation.
4. Stock distribution — number, principal holders, etc.
5. Organization chart.
6. Policy manual.

B. Financial

1. Latest financial statements.
2. Last available statements.
3. Ten year summary of statements.
4. Projected operating and financial statements.
5. Full description of securities, indebtedness, investments, and other assets and liabilities other than normal day-to-day accounts.
6. Chart of accounts and/or description of accounting practices with inventories, fixed assets, etc.
7. List of bank accounts, average balances.
8. Credit reports from banks and Dun & Bradstreet.
9. Federal income tax status; i.e., excess profits tax credit, any loss or unused E.P.T. credit carryforwards, latest year audited, any deficiency claims, etc.
10. Summary of state and local tax situation; i.e., applicable taxes, unemployment tax rate, any deficiency claims, etc.
11. Tax status of proposed transaction; recommendation for best method of acquisition.
12. Complete list of insurance policies, including description of coverage and cost; workmen's compensation rate.
13. Statement of responsible officer of business as to unrecorded or contingent liabilities.
14. Nature of inventory.

C. Sales

1. A brief description and history (if any) of the product line.
2. A ten year record of product sales.
3. A long range forecast of growth or contraction trends for the industry related to the product line.
4. A three to five year forecast of demand for the product.
5. An estimate of the industry's ability to supply present and anticipated demand.
6. A three to five year forecast of sales expectations for this company (share of the market).
7. An analysis of the effect of anticipated increased volume and/or cost reduction on:
   (a) Product demand and share of the market.
   (b) Market saturation and overcapacity.
8. An analysis of the effect of the geographic location of the new facility on:
   (a) Product demand and share of the market.
   (b) Distribution costs (freight savings, warehousing, etc.).
   (c) Competitive position.
9. A review of present sales management, selling force, advertising and sales promotion policies for adaptability and adequacy in relation to new facility.
10. A review of present competitors and their practices including:
    (a) Description of *competitive* products.
    (b) Location.
    (c) Estimated share of market.
    (d) Pricing policies.
    (e) Methods of distribution.
11. An analysis of present and/or probable pricing policies for the product line considering:
    (a) Competitive position.
    (b) Cost pricing.
12. An analysis of present and potential domestic and export clients.
    (a) Major types of customers and their per cent of sales.
    (b) Geographical location.
    (c) Buying habits.

D. Manufacturing

1. Description and layout of plant and property.
2. List of principal machine tools—age and condition.
3. Opinion *re* maintenance and "housekeeping."
4. Utilities — availability, usage, rates.
5. Estimated total annual fixed cost.
6. Organization, departments.
7. Transportation facilities.
8. Description of area, including climate, hazards from flood, etc.
9. Opinion *re* adequacy of auxiliary equipment—tools, patterns, material handling equipment, etc.
10. Detail expense schedule.
11. Building codes, zoning laws, etc.

E. Purchasing

1. Principal materials used.
2. Relation of material costs to sales.
3. Purchasing methods.
4. List of principal suppliers, items, location.
5. Inbound freight costs.
6. Work load—last twelve months.
   (a) Number of purchase orders issued.
   (b) Value of purchase orders.
   (c) Value of outstanding commitments.

F. Research and Engineering

1. Description and condition of facilities.
   (a) Drafting room and office.
   (b) Experimental room.
   (c) Laboratory.
   (d) Special test equipment.
2. Engineering personnel — quality and quantity of technical talents —employed—unemployed.
3. Product designs — evaluation; condition of drawings.
4. Patents and trade-marks—coverage, applications, litigation.

G. Labor

1. Analysis of present employee force—number, sex, age, etc.
2. Direct, indirect, administrative; number and cost.
3. Number of potential job applicants from surveys or census.
4. Determination of types of skills available in the area from state employment service and other sources.
5. Location and availability of students from high schools and technical schools.
6. Union—copy of contract.
7. Labor relations history.
8. Appraisal of working conditions.
9. Statistics on turnover; reasons.
10. Description of incentive system; average rates, incentive and hourly.
11. Employment and personnel policies.
12. Accident frequency.
13. Ratio of total labor cost to sales.
14. Pension and welfare plans.
15. Appraisal of transportation, recreation facilities, housing.
16. Evaluation of labor situation.

New Management Writing . . .

FRONT LINE COST ADMINISTRATION

By W. C. Cooling. Chilton Company, Book Division, Philadelphia, Penna. Pp. xl + 259. $5.00.

THE jacket of this text describes a book that should be of vital interest to not only foremen, or first-line supervisors as they are often called, but to middle and top management personnel as well. "The foreman need not be an industrial engineer. But if he is equipped with a solid foundation of industrial engineering facts he not only will increase his value tremendously, but he also *will spell the difference between high productivity or mediocre plant operation.*"

The purpose of the book, then, is to present in clear, understandable terms a series of industrial engineering facts for the foreman's use in administering management's cost control policies. In the opinion of the reviewer this purpose is well accomplished.

After an introductory chapter in which the importance of the foreman's job is clearly established, industrial engineering methods are explored one after the other.

In the second chapter it is emphasized that, although the foreman is not expected to be a methods engineer, it is his duty to make certain that the developed methods are properly installed. Some of the methods engineer's tools are explained, such as the flow process chart, the multiple activity chart, and work simplification principles. The next chapter leads into the use of production standards as the basis for estimating, planning and scheduling, layout, and equipment justification. An explanation then follows of the various ways in which production standards can be developed. The standard data approach is discussed. Common types of incentive plans are outlined. The next three chapters embrace a description of the various kinds of incentives—individual and group; methods by which incentive coverage can be extended; and suggestions for the proper administration of a wage incentive plan. Chapter VIII outlines some of the pitfalls that must be avoided in a wage incentive plan.

The next chapter provides a means by which the work of indirect employees can be measured. An interesting device is discussed—the use of manning data. Those plagued with inequities between the earnings of incentive employees and those on daywork will find this chapter particularly stimulating.

Chapter X asks, "What About Product Design and Materials?" The author explains that although this is usually considered a part of work simplification, he considers it too important not to treat separately. The potential savings are too great.

A rather comprehensive discussion of job evaluation follows. Then a chapter on the foreman's part in maintaining an adequate and profitable maintenance program.

Chapter XIII stresses the importance of operating reports. Several examples are included and management is advised that it is their duty to supply and issue intelligent cost and operating reports to properly guide the foreman.

The final chapter emphasizes the importance of training—"a never ending part of the foreman's job."

A pleasing "bonus" is provided in the five appendices of the book. These include a job description for foreman, a performance review form, some actual examples of production standards, an outline to supplement the text for supervisory training, and last, the suggested way to installing an incentive plan.

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ADMINISTERING A CONVERSION TO ELECTRONIC ACCOUNTING: A Case Study.

By Harold Farlow Craig. Division of Research, Graduate School of Business Administration, Harvard University, Boston. 1955. 224 pp. $2.50.

To quote the author of this most interesting book, ". . . this study is concerned with the administrative aspects of the installation and operation of mechanized systems of accounting and recording . . ." in the Commercial Department of a large mutual life insurance company. This is a succinct and accurate general description of the content of the book.

In the more specific sense, this is a study of particular administrative problems connected with the introduction of significant changes in procedures, the resulting effect upon the people who worked in the area in which the change was introduced and how these problems were successfully resolved by the management of the Commercial Department. Attention is focused primarily on the behavior of the group of middle management people directly responsible for administration (*i.e.*, management) of the technical changes. It also provides brief, pertinent descriptions of behavior at top management, supervisory and clerical levels of the organization. The study concludes with analytical observations and a generalized statement of recommendations and conclusions.

In a summary paragraph, Professor Craig says: "The pattern of evidence showed that a very effective job of administration had been and was being done by the management of the Commercial Department. . . . The administration of this installation of punch card machinery was successful in a number of ways. First, it had increased the capacity of the organization to perform its functions effectively. Secondly, it had lowered the cost of performance of those functions. Thirdly, the personnel of the department had developed a feedback of enthusiasm which had brought forth the latent talent of individuals and had strengthened the capacity to develop and implement better ways of performing its functions."

Happily, the research methods used to develop the factual, clinically descriptive details which make up most of this report are well described. The data presented are direct evidence of the competence and skill with which Professor Craig employed these techniques during the thirteen months (October 1952 to December 1953) spent in the insurance organization.

Those not familiar with typical case study organization and presentation of material may find it advisable to read this book in the following sequence:

Introduction
Part I, The Commercial Department Before and After Conversion
Part II, Administrative Behavior During Conversion
Part III, Observations and Conclusions

Such a procedure may well optimize the yield from reading this excellent case study. ■

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